

The exploitation and control of woodland and scrubland in the Byzantine world*

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I

A welcome and necessary aspect of the renewal of studies of the Byzantine economy has been the analysis, sometimes in both the technical and the broader organisational aspects, of the production and redistribution of particular goods. One only has to think of some recent work concerning mining and metallurgy, minting, silk-production, glass-making, potteries, shipping, and *salsamenta*,¹ to realise the potential significance of such studies, the

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1. For example, J.-P. Sodini et al., *Les carrières de marbre à l'époque paléochrétienne*, *Aliki* 1 (École Française d'Athènes, 1980); S. Vryonis, 'The question of the Byzantine mines', *Speculum* 37 (1962) 1-17; A. Bryer, 'The question of Byzantine mines in the Pontos . . .', *Anatolian Studies* 32 (1982) 133-150; M. Hendy, *Coinage and money in the Byzantine empire 1081-1261* (Dumbarton Oaks 1969); A. Muthesius, 'A practical approach to the history of Byzantine silk weaving', *JÖB* 34 (1984) 235-254; *eadem*, 'From seed to samites: aspects of Byzantine silk production', *Textile History* 20 (1989) 135-149; J. Philippe, *Le monde byzantin dans l'histoire de la verrerie* (Bologna 1970); G. Weinberg, 'A medieval mystery: Byzantine glass-production', *Journal of Glass Studies* 17 (1975) 127-141; T. Noonan, 'Technology transfer between Byzantium and Eastern Europe: a case study of the glass industry in early Russia', *Medieval Studies in Minnesota* 3 (St Cloud 1988) 105-111; *Recherches sur les amphores grecques*, edd. J.-Y. Empereur-Y. Garlan (École Française d'Athènes 1989); G. Bass-F. van Doorninck, *Yassi Ada I* (Texas A & M University 1982); J. Smedley, *Byzantium, the Crimea and the Steppe 550-750* (Unpublished doctoral thesis, Birmingham University, 1984), chap. 5, iii ('Economy and trade').

need for the historical study of all types of economic activity, and how unilluminating has become the incantation of such statements as that the Byzantine economy was 'overwhelmingly' rural! (almost invariably made with reference to the primary products of a narrowly defined agriculture), or that centres of population were 'characterised by consumption', or even that commercialised redistribution was 'feeble' and stagnant in the Early Byzantine period.²

The problem with moving beyond such generalisations is, on one level, that of the quantitative comparison of sectors of activity, including commercialised redistribution. Progress for Byzantinists depends partly upon forms of archaeological enquiry, for the study of production and the pathways (but not the nature) of redistribution. Many branches of production and some aspects of redistribution have proved susceptible to archaeological exploration. Indeed the possibilities of excavation and laboratory-analysis have obviously stimulated the study of an 'artefactual' level of Byzantine economic history (which needs further integration). There is even a danger that their very susceptibility to investigation will again distort the economic picture, reviving the spectre of a Byzantium totally oriented towards commodity-production and trade (against which the incantations have been directed).³ But progress depends too on archaeologically led surveys and on archival studies, oriented as these can be towards

2. For this 'new tradition' see for example M. Hendy, 'Economy and state in Late Rome and Early Byzantium: an introduction', in *idem*, *The economy, fiscal administration and coinage of Byzantium* (London 1989) I; or J. Haldon, 'Some considerations on Byzantine society and economy in the seventh century', *BF* 10 (1985) 75-112 (an important article in fact concerned with much of the Early and Middle Byzantine periods). For an alternative model see D. Engels, *Roman Corinth, an alternative model for the classical city* (Chicago 1990) 131-142.

3. The spectre is palpable in N. Oikonomidès, 'Silk trade and production in Byzantium from the sixth to the ninth century: the seals of *kommerkiarioi*', *DOP* 40 (1986) 33-53. But the traditional view of the Byzantine economy was effectively discredited: see M. Hendy, *Studies in the Byzantine monetary economy c.300-1450* (Cambridge 1985), hereafter *Hendy*.

the study of the rural economy.⁴ At the juncture of these various avenues of enquiry a balanced view may emerge.

This then is the context, one of unresolved but progressive discussion, in which a study of a relatively important yet absolutely neglected group of economic activities, those affecting woodlands and scrublands, becomes opportune. It can remind us of the ubiquity of commercialised redistribution (at however lowly a level), of a multiplicity of crafts and primary and secondary products, and of the broad front along which peasants dealt with markets, but also of the broad base of rural subsistence. It can and must also relate the Byzantine material to discussions going on in related disciplines about types and levels of exploitation, the factors affecting their environmental impacts, and the history of their impacts. A study of the control of such exploitations, that is, of the primary activities, also provides a necessary reminder that taxation and other dues could and did take many forms throughout the Byzantine era.

The neglect of this group of economic activities by historians could be attributed to their low profile in the sources. The Byzantine literary world unfortunately had no tradition of geographical literature such as flourished in the Islamic world.⁵ We cannot expect much from the Byzantine *ekphrasis*. Ioannes Kameniates, for instance, in his description of the natural resources of Southern Macedonia, has nothing to say about its forests, which certainly

4. The methodological and conceptual problems of the integration of survey-findings into Byzantine economic history perhaps deserve a special study. The value of certain forms of interdisciplinary survey for the study of medieval rural economies seems to have been questioned, perhaps in ignorance of the Eastern Mediterranean material already available. For such criticisms, which are to be rejected, see the views expressed in A. Bazzana-G. Noyé, 'Du "Bon usage" de l'archéologie extensive: une réponse en forme de bilan . . .', *Castrum* 2 (Rome-Madrid 1988) 543-562 (for instance at 558, referring to intensive survey, 'l'inutile et utopique exhaustivité'; at 559, the alleged 'poverty' of this type of survey's results for our understanding of medieval settlement-systems!).

5. For the Islamic tradition see A. Miquel, *La géographie humaine du monde musulman jusqu'au milieu de 11^e siècle* I-III (Paris 1973, 1975, 1980).

still existed then (v.i.).⁶ And documents of a legal nature are very few compared to western European legal material of the middle ages. These are nevertheless our most important source. Many of their references to aspects of woodland and scrubland might be missed by a late twentieth-century reader. They are probably the pre-industrial exploitations of Mediterranean landscapes of which the historian is today least empirically aware. They therefore become the most easily marginalised aspects of studies of the Byzantine rural economy. Such studies, when dealing with production, are naturally concentrated upon an economic core of grain-production, viticulture, arboriculture in the sense of production of cultivated fruit- and nut-trees, above all the olive, and sometimes pastoralism (which does of course exploit woodlands and scrublands: see below, V).⁷

Despite the evidential problems it is still necessary for practical purposes to select material. This study has concentrated upon Greece and its islands, Cyprus, Anatolia, and Syria. There are

6. *Ioannis Caminiatae De expugnatione Thessalonicae*, ed. G.Böhlig (Berlin 1973) 55-6. Only at 5.15 does he refer to game (deer) found in the 'mountains' (ὄρη) around the Langadas Basin, which is in practice a reference to woodlands. The word *oros* was virtually synonymous with woodland. One fifteenth-century *ekphrasis*, Ioannes Eugenikos on the village of Pedina in the Peloponnese, does at least mention pannage: S.Lampros, *Παλαιολογία καὶ Πελοποννησιακά* I (Athens 1912) 52.

7. For these aspects of the Middle Byzantine rural economy see now A.Harvey, *Economic Expansion in the Byzantine Empire 900-1200* (Cambridge 1989) chaps.2-5 (hereafter *Harvey*); for the same aspects of the Late Byzantine rural economy J.Nesbitt, *Mechanisms of agricultural production on estates of the Byzantine praktika* (Ph.D., Wisconsin University 1972); N.Kondov, 'Das Dorf Gradec (demographisch-wirtschaftliche Gestalt eines Dorfes im Gebiet des unteren Strymons zu Beginn des XIV.Jh.)', *Études Balkaniques* 7 (1971) 31-55; *idem*, 'Produktionsorganisatorische Verschiebungen bei dem Weinbau in der ersten Hälfte des 14. Jahrhunderts im Gebiet des unteren Strymons', *Études Balkaniques* 9 (1973/1) 67-76; *idem*, 'Über den wahrscheinlichen Weizenantrag auf der Balkanhalbinsel im Mittelalter', *Études Balkaniques* 10 (1974/1) 97-109; *idem*, 'Das Dorf Gradec . . .', *Études Balkaniques* 13 (1977/3) 71-91; A.Laiou-Thomadakis, *Peasant Society in the Late Byzantine Empire, a Social and Demographic Study* (Princeton 1977), parts of chaps. 2 and 5. For Byzantine pastoralism in particular see *Hendy* 55-57 and *Harvey* 149-157; for some Late Byzantine evidence from S.E. Macedonia, Kondov, 'Das Dorf Gradec . . .' (1977) 79-85; for its late medieval Pontic variant, A.Bryer, 'Greeks and Türkmens: the Pontic exception', *DOP* (1975) 113-148.

documented regions which have been excluded, namely Early Byzantine Egypt and Middle Byzantine Italy.⁸ On the other hand one has to adopt a fairly 'long-term' and comparativist perspective, necessary if any sense is to be made of fragmentary material. The approach is made possible by great continuities observable in the branches of material culture and technology which concern us. At the same time the long view allows us to glimpse alterations to the bases upon which the resources of woodland and scrubland were controlled.

This then is a brief survey of the problems and prospects of a history of the exploitation of the wooded parts of the Byzantine resource-base, the problem of the range of exploitations practised therein during the Byzantine era and their economic significance, and the problem of the conditions under which woodlands and scrublands were exploited, as a contribution to the debate outlined above.

'Woodland' will refer to areas dominated by what we distinguish empirically as trees, though generically they are the same as bushes. 'Scrubland' will often refer to areas dominated by the same types of plant in their stunted or 'bushy' forms, the *maquis* and *pseudomaquis* vegetational communities, which are scrubland precisely because of their regular exploitation and revert to woodland when the pressures upon them ease. A third type of scrubland which concerns us, in these parts of the E. Mediterranean, *garrigue* (Greek *phrygana*) is non-arborescent. *Shiblyak*, another type of arborescent scrubland (all deciduous unlike *maquis* and *pseudomaquis*) is more typical of the central Balkans, than of the Mediterranean.⁹ Finally 'woodland' does not include orchards, which need to be treated separately.¹⁰

8. For remarks about the control and exploitation of woodland and scrubland in another part of the Byzantine world see J.-M. Martin-G. Noyé, 'Les campagnes de l'Italie méridionale byzantine (X^e-XI^e siècles)', *Mélanges de l'École Française de Rome. Moyen Age* 101 (1989) 581 and 583-4.

9. I follow the categories of O. Rackham, 'Observations on the historical ecology of Boeotia', *ABSA* 78 (1983) 291-351, hereafter *Rackham*(2). I have no references which I can relate to *shiblyak*.

10. On the traditional importance of orchards as a source of fuel, fodder and light building materials see O. Rackham, 'Land-use and native vegetation in Greece',

II

The botanist Turrill wrote over sixty years ago: 'In spite of much search I have found little which throws light on the use and misuse of vegetation in the Byzantine empire.'¹¹ He was talking about woodland and scrubland in the Balkans, and, from his own viewpoint, about a significant facet of economic history which no Byzantinist had yet analysed. He felt unable to proceed. To approach this facet of economic history we have to consider Turrill's problem and methodologically we have first to temporarily separate the problem of the history of exploitation of woodland and scrubland from that of the conditions of exploitation. Advances in the study of environmental history have facilitated such an approach. In fact for the Byzantine world we are dependant in this respect upon environmental studies, in particular upon landscape-history. But without reference to recent or contemporary evidence the only directly relevant activity which landscape-history (as revealed by palynology, alluvial chronology, and settlement-survey) seems to reveal is that of tree-felling, whether for assart or purely for timber.

If, however, landscape-history is considered in the light of the structures of existing E. Mediterranean plant-communities and the traditional patterns of their exploitation, it becomes possible to consider the history of most of the activities which concern us, at least under the general heading of their environmental impact, in other words Turrill's question. This is important, for it seems that given certain political, economic, and environmental conditions these activities did not in aggregate and over the long

Archaeological aspects of woodland ecology, edd. M. Bell-S. Limbrey (B.A.R. S142, 1982), hereafter *Rackham*(1), 192 (with specific reference to Greece). Alan Harvey makes useful observations on Byzantine olive-growing and mulberry-plantations (*Harvey* 144-149). Ph.Koukoulès, Βυζαντινὸν βίος καὶ πολιτισμὸς (Athens 1948-1955), hereafter *Koukoulès*, at V 274-79 describes some arboricultural practices (planting, grafting, etc.).

11. W. Turrill, *The plant-life of the Balkan Peninsula. A phytogeographical study* (Oxford 1929) 192.

term deplete arboreal resources seriously. There could be a 'degeneration' from woodland to scrubland, but scrubland, as ethnographers have shown (v.i.) could be more useful economically than woodland in many respects.

Such a framework, in which the various kinds of evidence mentioned, including literary and archival, are judged together within a long-term perspective, is essentially present in Rackham's study of Boeotia, the first systematic study of Greek regional landscape-history with the emphasis on the vegetation.¹² This study of the structures, extent, and distribution, of plant-communities and the problem of the changes which these may have undergone since the Neolithic deals with the aspect of landscape-history most relevant for present purposes.

Rackham draws on ethnographic studies to identify some of the range and the intensities of traditional exploitations of woodland and scrubland in southern Greece, and establishes the consequences of particular exploitations (e.g. felling, coppicing, pollarding, tapping, browsing, burning for pasture) over the long term in an Eastern Mediterranean setting, so as to attain a qualitative model in which these various exploitations (implicitly for the needs of rural communities) were broadly in balance with the regenerative capacities of arboreal resources throughout the historical era. Ethnographic studies remind us of the ubiquity, enormous scale and variety, and indispensability, of these exploitations in traditional E. Mediterranean communities; also implicitly of the adaptation of exploitation, when it is for subsistence, to the capacities of the resource-base.¹³

12. Rackham(2). Rackham's subject is not really addressed in the final publications of two Greek regional surveys so far available: *The Minnesota Messenia Expedition* (Minnesota 1972 onwards) and C.Renfrew-M.Wagstaff, *An island polity. The archaeology of exploitation in Melos* (Cambridge 1982).

13. See for instance H.Forbes, 'Gathering in the Argolid: a subsistence subsystem in a Greek agricultural community', *Annals of the New York Academy of Sciences* (hereafter ANYAS) 268 (1976) 251-264; M.Forbes-H.Koster, 'Fire, axe and plow: human interference in local plant-communities in the Southern Argolid', ANYAS 268 (1976) 109-126; H.Forbes, 'Farming and foraging in prehistoric Greece: a cultural ecological perspective', ANYAS 268 (1976) 127-142; N.Gavrielides, 'The impact of olive growing on the landscape in the Fourni valley', ANYAS 268 (1976) 143-157.

It is important for present purposes that this aspect of the resource-base was not necessarily degraded or exhausted by exploitation on a large scale; that for instance the arboreal aspect of central Greece in the nineteenth century was very similar to that of Roman central Greece, despite the periodic intensification of exploitation;¹⁴ and that pollarding and coppicing have been practised at the same spots for centuries.¹⁵ But it is equally important that exploitation has fluctuated in intensity both locally and according to broad trends during the historical era, as landscape-archaeology, palynology, and historical studies have begun to show, and that (not apparently Rackham's view) in some E. Mediterranean settings these intensifications may have contributed to causing a degree of erosion which prevented a fully cyclical regeneration of arboreal resources on uncultivated land.¹⁶

The work of Jacques Lefort and his team in Eastern Macedonia supports this view. Their projects have explored the implications of Byzantine documents (fiscal, for instance) and *Reiseberichte* of the Ottoman era for the history of the landscape. Interrelating geographical observations (of the vegetation, for instance) with demographic, toponymic, and topographic data, their studies delineated stages in the clearance of woodland between the eleventh and mid fourteenth centuries, as well as during the Ottoman era. More generally, using some of the palynological data available, they delineated a series of fluctuations in the extent of woodland (and probably scrubland) since Antiquity, in which regeneration is never truly cyclical.¹⁷

14. Rackham(2) 329-37 and 344-7.

15. Rackham(2) 320-1; Rackham(1) 192; also J. Wright et al., 'The Nemea Valley Archaeological Project: a preliminary report', *Hesperia* 59 (1990), 592, n. 30.

16. The causes and extent of erosion in the Byzantine world are vexed questions which can only be properly studied within a multiperiod framework. But Hendy 58-68 ('The problem of erosion') establishes that lowland alluviation, therefore presumably upland erosion, was happening in the Byzantine world. But it is premature to assign 'deforestation' a role.

17. See J. Lefort, 'Radolibos: population et paysage', *TM* 9 (1985) 195-234, particularly 197-222; *idem*, 'Population and landscape in Eastern Macedonia during

These studies of northern and central Greek landscapes should be seen as complementary rather than contradictory outlines of exploitative history. Their interpretation within the framework of Byzantine economic history is difficult of course.¹⁸ To what extent, if ever, does the depletion of arboreal coverage merely represent local demographic pressures at the subsistence-level, and to what extent the pressures of the fisc, the market, and the proprietorial regime, with their demands for agricultural and arboreal products? But the value of pursuing these kinds of projects is clear. For most regions of the Byzantine world no archives have survived, and even where they have they cover small patches of regions over very short disconnected timespans. So the indications of tree-loss, accompanied as they sometimes are by evidence, palynological or archaeological, of the spread of agriculture, offer another means of evaluating general models of Byzantine economic change (at least of the descriptive aspect of a model of economic pulsations). The apparent chronology and trajectories also make interesting comparison with those for the post-Roman medieval west. At present they seem rather different for the fifth to twelfth centuries.¹⁹ A pattern has now emerged

the Middle Ages: the example of Radolivos', *Continuity and Change in Late Byzantine and Early Ottoman Society* (Birmingham 1986) 11-21, particularly 15 onwards; and B.Geyer, 'Esquisse pour une histoire des paysages depuis l'an mil', *Paysages de Macédoine* (Paris 1986) 99-116.

18. See Geyer, *op.cit.*, for a discussion in which the problem of economic factors is raised.

19. For a synthesis of research on the extent of woodland and early medieval clearance, still quoted subject to revisions, see C.Higounet, 'Les forêts de l'Europe occidentale du V^e au XI^e siècle', *Agricoltura e mondo rurale in occidente nell'alto medioevo. Settimane di studio del centro italiano sull'alto medioevo* XIII (Spoleto 1966) 343-98, particularly 392-7 on several 'pulsations' of clearance and regeneration prior to the 'grands défrichements' of the twelfth and later centuries. For good examples of the revision of his work see Oliver Rackham's studies of English medieval woodlands. See C.Wickham, 'European forests in the Early Middle Ages: landscape and clearance', *L'ambiente vegetale nell'alto medioevo. Settimane di studio* XXXVII (Spoleto 1990) 499-501 for a qualified reaction to the western environmental and textual evidence. While not actually discussing whether or not the pressure on woodlands had eased before the sixth century Wickham can argue for more continuity of settlement between Roman and early medieval times around and within wooded areas than was once thought likely. For relative continuity in levels of afforestation see M.Bell,

which links the French Eastern Macedonia project's data with palynological studies from other parts of Greece and Anatolia.

To take first those that are related to calibrated C₁₄ readings; at Khimaditis in W. Macedonia a steady decline in arboreal pollen-values and an advance of plants associated with agriculture and woodland-clearance had begun by ca.850 A.D.;²⁰ at Pertouli in Thessaly by ca.900 A.D.;²¹ at Litokhoros in W. Macedonia from ca.1000 A.D.²² This retreat and probable thinning of woodland and extension of agriculture, herding, and other exploitations, arguably lasts in the palynological record until the fourteenth century.²³

A corresponding arboreal pollen-trajectory is recognised, though without comment, by its author Bottema, in a sequence from Lake Volve in central Macedonia.²⁴ It is most plausible. At a depth of 1.20m the imported *zea mays* (sweetcorn) first occurs, associating its level arguably with the early eighteenth century,²⁵ beside a steep downward trend for *quercus cerris*, an oak associated with naturally arable land, therefore land being cleared, parallel also with a decline of montane trees such as beech.

'Environmental archaeology as an index to continuity and change in the medieval landscape', *The rural landscape of medieval England*, edd. M.Aston-D.Austin-C.Dyer (Oxford 1989) 273 onwards. Geyer (*Paysages de Macédoine* 101-6) in fact proposed the parallelism of a sequence of deposits and incisions in a ravine in S.E. Macedonia, reflecting phases of deforestation, with a pollen-profile from Litokhoros in W.Macedonia and known pulsations of the regional economy.

20. J.Turner, 'The vegetation of Greece during prehistoric times: the palynological evidence', *Thera and the Aegean world I* (London 1978) 769, using S.Bottema's unpublished doctoral thesis *Late Quaternary vegetational history of northwestern Greece*. The changes established at these and other sites sometimes relate to arboreal pollen that could be either woodland or scrubland-derived.

21. N.Athanasiades, 'Zur postglazialen Vegetationsentwicklung von Litokhoros Katerinis und Pertouli Trikalon (Griechenland)', *Flora* 164 (1975) 112-118; Turner, *art.cit.* 769.

22. Athanasiades, *art.cit.* 123; Turner, *art.cit.* 770.

23. S.Bottema, 'Palynological investigations in Greece with special reference to pollen as an indicator of human activity', *Palaeohistoria* 24 (1982) 281; Athanasiades, *art.cit.*, 127.

24. Bottema, *art.cit.*, 287.

25. *Ibid.*, 265.

This decline in arboreal pollen-values is from a peak at *ca.* 2.30m, presumably a 'post-Black Death' phenomenon; preceded by a trough at *ca.* 3m, presumably reflecting a 'pre-Black Death' productive and demographic peak; preceded in turn by another peak in arboreal pollen-values at *ca.* 4.30m, presumably in the Early Middle Byzantine period; rising steeply from a trough at *ca.* 5.70m which presumably reflects the Late Roman/Early Byzantine productive and demographic peak recorded in recent Greek archaeological surveys.²⁶ Bottema had already established that at a depth of 6m the pollen-spectrum reflects Greco-Roman agricultural conditions.²⁷

Other less complete sequences from S.E. Macedonia can be related to it. At Philippi profiles from two cores extracted from the drained lakebed (Lake Pravi) contain deposits reaching, it is calculated, to the mid fifth century A.D., at which time 'the plain of Drama and the hill-country around was not deforested as it is today, but carried a deciduous oak-dominated woodland' which was growing on rich and poor soils. Clearance was 'not taking place on a large enough scale to disturb the wooded environment'.²⁸ This Early Byzantine situation prolongs that of the Greco-Roman era, an era of 'mixed oak forest, some thinner woodland, (and) open land', which had been preceded by an

26. For the vegetational phenomena see Bottema, *art.cit.*, Fig.4 (unbound). For archaeological indications of an Early Byzantine demographic peak in Greece and Cyprus see for instance J.Bintliff-A.Snodgrass, 'The Cambridge/Bradford Boeotian Expedition: the first four years', *The Journal of Field Archaeology* 12 (1985), 157 (Table 6); C.Runnels-T.van Andel, 'The evolution of Settlement in the Southern Argolid, Greece: an economic explanation', *Hesperia* 56 (1987) 324 (Fig. 15); D.Rupp, 'The Canadian Palaipaphos Survey Project. Third preliminary report, 1983-1985', *Acta Archaeologica* 57 (1986) 32 (Table 1), on which one should consider sites labelled 'Earlier Roman/Later Roman, Later Roman, Later Roman/Earlier Byzantine', and 'Earlier Byzantine', to form a qualitative impression of Early Byzantine site-numbers relative to other periodic peaks. J.Wright-J.Cherry-J.Davis-E.Mantzouranis, Το ερευνητικό αρχαιολογικό πρόγραμμα στην κοιλάδα της Νεμέας κατά τα έτη 1984-1985, *Αρχαιολογικά Ανάλεκτα Αθηνών* 18 (1985) 92 (εκ.4), meanwhile remind us that no trend of this kind is detectable everywhere.

27. Bottema, *art.cit.*, 265-6.

28. J.Greig-J.Turner, in *Excavations at Sitagroi, a prehistoric village in northeast Greece*, edd. C.Renfrew et al. (Los Angeles 1986) 46 and 47.

era of total afforestation.²⁹ At Gravouna, between the Nestos Delta and Mt Lekane, the trajectory of arboreal pollen-values (TAPV) for *quercus* suggests a gradual cumulative decline during the Middle and Late Byzantine eras, followed by a resurgence, as at Volve, then by a stripping of the oak-dominated cover during the Ottoman era.³⁰

Not surprisingly the speed and extent of change vary. But the parallelism of TAPVs right across N. Greece and their conjuncture with S. Greek and Cypriot archaeological survey-data suggest the general profile of, and influences upon, the Byzantine environmental bridge between Antiquity and the Ottoman era. There is an Early Byzantine Greek conjuncture between falling TAPVs and settlement-intensification. The N. Greek TAPVs then rise as S. Greek settlement disintensifies, an Early Middle Byzantine ('Dark Age') phenomenon. Then as the TAPV-trend is reversed settlement re-intensifies, archaeologically a phenomenon of the eleventh and later centuries.³¹ Owing to the accidents of pollen-rain preservation, normally poor in S. Greece,³² and to the late development of the 'multi-period'

29. J.Grieg-J.Turner, 'Some pollen diagrams and their archaeological significance', *Journal of Archaeological Science* 1 (1974) 182 (Fig.3). The same profiles are discussed in J.Turner-J.Grieg, 'Some Holocene pollen diagrams from Greece', *Review of Palaeobotany and Palynology* 20 (1975) 194-200. The cores were extracted with a view to supplementing for the protohistoric and historical eras the data of a Dutch survey of 1960, for which see briefly T.van der Hammen et al., 'Palynological study of a very thick peat-section in Greece and the Würm-Glacial vegetation in the Mediterranean region', *Geologie en Mijnbouw* 44 (1965) 37-39.

30. Turner-Grieg, *art.cit.*, 202-3. The Byzantine period is implicitly at section G1/2, Fig.6 (202).

31. The connection between two distinct phases of Early and Middle Byzantine settlement-intensification and the intensification of land-use has already been successfully documented for a region of S.Greece, with a correlation of the chronologies of alluviation and site-occupation. See T.van Andel-C.Runnels-K.Pope, 'Five thousand years of land use and abuse in the Southern Argolid, Greece', *Hesperia* 55 (1986), 103-28 (see particularly Fig. 15). The apparent disintensification of settlement from the seventh to ninth centuries is accompanied by a resurgence of pines and maquis: *art.cit.*, 122, reference to unpublished pollen-profiles.

32. It is not absent there, but is rarely useful for present purposes, for instance an analysis of a pollen-profile from Lake Copais in Boeotia: *Rackham*(2) 339-343. See *The Minnesota Messenia Expedition* I chap.12, by H.Wright, for the extremely meagre

survey in N. Greece,³³ the archaeological and palynological phenomena are still only locationally linked in the S. Argolid in the Peloponnese.³⁴ But it is an entirely reasonable working hypothesis that their conjuncture applies widely and that they reflect demographic and agricultural expansions and contractions besides reflecting the economic regime.³⁵

Archaeological and palynological research in S. Anatolia, not apparently conducted with any reference to the Greek data, now reveals the same pattern: an advance of rural settlement and retreat of woodland in Antiquity, followed by a reversal of these trends in the Early Middle Byzantine period lasting to ca. 1000 A.D.³⁶ By that time the rate of felling had overtaken the woods' regenerative capacities, or clearance for agriculture had become significant, or both. For eleventh-century Anatolia we have a rare reference to woodland-clearance for agriculture, the will of Eustathios Boilas of 1059.³⁷ Though it involves a paraphrase of a line from Psalm Seventy-three it is clear enough. Boilas states that all the rural properties which he then held were cleared by

results for our purposes of a search for polliniferous sediments all over the Peloponnese. For an example of the difficulty of interpreting the small S. Greek pollen-residues see W. Randolph, 'Excavations at Porto Cheli. Preliminary report V: the Early Byzantine remains', *Hesperia* 48 (1979) 321-4 (M. Sheehan, 'Pollen analysis of Halieis sediments').

33. The Strymon Delta Project, the Langadas Basin Survey, and the Grevena Survey have not yet published the relevant data.

34. See note 31 above.

35. Demographic resurgence and the revival of agriculture as overriding trends for much of the Middle Byzantine period is the thesis of *Harvey*.

36. N. Roberts, 'Human-induced landscape change in South and Southwest Turkey during the later Holocene', *Man's role in the shaping of the Eastern Mediterranean landscape*, edd. S. Bottema-G. Entjes-Nieborg-W. van Zeist (Rotterdam-Brookfield 1990) 59-64. See also M. Harrison, 'Nouvelles découvertes romaines tardives et paléobyzantines en Lycie', *Comptes rendus de l'Académie des Inscriptions et Belles-Lettres* (1979) 222-239 for references to the natural reforestation of Early Byzantine and then of Middle Byzantine phases of upland-settlement and terraces in S.W. Turkey. Hopefully recent and ongoing interdisciplinary surveys in S.W. Turkey (the British survey of the *territorium* of Balbura and the German survey of the *territorium* of Kyaneai) will contribute to this discussion.

37. See *Harvey* 64-65 for a discussion of this document in the context of the very longlasting expansion of the Middle Byzantine rural economy.'

him (presumably his slaves and tenants). The land had been ἄλσώδη καὶ δυσχερῇ ('wooded and rough') until πελέκει καὶ πυρὶ κατατεφρώσας ὡς ὁ ψαλμός ('reducing (it) to ashes with axe and fire . . .'), he created a whole series of productive features.³⁸

The evidence, both archaeological and palynological, begins to suggest that a considerable demographic and economic decline affected the countryside as well as urban sites in most parts of the Byzantine world at the end of Late Antiquity and that recovery was only slow. But it is unlikely that the regenerating woodlands and scrublands were neglected. During the Early Middle Byzantine period they would simply have been under less pressure.

As far as the Balkans, Anatolia, and Syria, are concerned then one need not accept the recent assertion (and common assumption) of 'the comparative scarcity' of wood in the Byzantine world,³⁹ at least for the Middle Byzantine era, except for the central Anatolian plateau, which was already treeless in Antiquity and continued to be so (but still supports some scrubland even today).⁴⁰ Rather, wherever significant spontaneous woodland coverage existed in Antiquity, and still existed in the early-to-mid nineteenth century (and in some areas still exists), in N.W., N. and N.E. Anatolia,⁴¹ and in N. and W. Syria,⁴² one can an-

38. 'Le testament d'Eustathios Boilas', ed. and comm. P. Lemerle, *Cinq études sur le XI^e siècle* (Paris 1977), text: 20-29, l. 49. S. Vryonis unaccountably translates ἄλσώδης as 'foul': *idem*, 'The will of a provincial magnate, Eustathios Boilas (1059)', *DOP* 11 (1957) 265. Boilas' estates were probably in N.E. Anatolia (*idem*, 275-6). Lemerle's vague location in S.E. Anatolia (Lemerle, *op.cit.*, 47) is rightly questioned: A. Kazhdan, 'Remarques sur le XI^e siècle byzantin à propos d'un livre récent de Paul Lemerle', *B* 49 (1979) 492 onwards. Boilas refers to the clearance and equipping of one estate (Lemerle, *op.cit.*, text: 11.48-55) then lists the other somewhat similarly reclaimed estates (11.55-60).

39. See 'Wood and woodworking', *The Oxford Dictionary of Byzantium* III (Oxford 1991) 2204.

40. For the treelessness of the central Anatolian plateau in Antiquity see Meiggs 392-3. Its treelessness in the Byzantine era can also be inferred from descriptions, for which see Hendy 40-44. See also Harvey 128.

41. See Meiggs chap. 2 and 393-4 for the clear correspondence between the arboreal geography of Antiquity and today.

42. See N. Rowton, 'The topological factor in the Hapiru problem', *Studies in honor of Benno Landsberger* (Chicago 1965) 376-382 for Arabic, Frankish, seventeenth-to-

ticipate that fluctuations in woodland-coverage such as those identified in Greece will have occurred. In Syria the Middle Byzantine emperors reoccupied precisely the arboriferous northern and western regions. And the 'bare hills of Greece'⁴³ were not typically or usually bare. Where there is no woodland there is often the extremely resilient and economically productive scrubland already mentioned, which can form the major component of the local vegetation,⁴⁴ and which could have already predominated in Antiquity where it predominates today.⁴⁵

For the interior of E. Balkans, while projects like those conducted in Greece and Turkey have not yet offered models of changes in the extent of arboreal coverage during the Byzantine era,⁴⁶ studies of the literary sources suggest vast areas of lowland and upland arboreal coverage of which the former has only disappeared since the Middle Byzantine era while the latter

nineteenth-century travellers', and nineteenth-to-twentieth-century geographers' references, to the extensive woodlands of northern and western Syria, now severely depleted; also Meiggs 394-5, and W.Djobadze, *Archaeological investigations in the region west of Antioch-on-the-Orontes* (Stuttgart 1986) 3.

43. C.Wickham, 'European forests in the Early Middle Ages' (*art.cit.*, n19) 533.

44. See Rackham(2) 298 for the fact that about a third of Boeotia is covered by scrubland. 39% of central Greece as a whole is covered by woodland and scrubland, including within it some grassland (18.4% 'forests', 20.6% 'partially forested and grazed'); N.Yassoglou-D.Catacoustinos-A.Kouskolekas, 'Land use in the semi-arid zone of Greece', *Land use in semi-arid mediterranean climates* (UNESCO 1964) 64 (Table 2). In one Argolid commune the *maquis* scrubland recently covered 57% of the surface while bare rock and steppic grass covered 10.31%; Forbes-Koster, *art.cit.* n13, Table 4. In another Argolid commune *maquis* covered 47.8% of the surface: Gavrielides, *art.cit.* n13, 151. Woodland and some forms of scrubland cover 20.57% of SE Macedonia today, a calculation that I draw from G.Stergiades, 'Δάση της Μακεδονίας, ο πλούτος της Ελλάδος', *Μακεδονική Ζωή* 301 (June 1991) 32 (Fig.1).

45. See Rackham(2) 329-337 and 344-347. As already stated Rackham's is the only multidisciplinary study of the vegetational history of a Greek region throughout the historical era. I take his model of continuity to be useful, *pro tem.*, for other long-settled E.Mediterranean coastal regions.

46. See now E.Bozilova-S.Tonkov, 'The impact of man on the natural vegetation in Bulgaria from the Neolithic to the Middle Ages', *Man's role in the shaping of the Eastern Mediterranean landscape*, 327-332, which though useful ends effectively with the Roman era.

remains,⁴⁷ or rather is regenerated (the mining and smelting industries having exploited these upland-resources since prehistoric times).⁴⁸

However tentative are some of the findings of this mixture of disciplines currently, there is a clear methodological lesson. Byzantine historical geography or regional studies, the headings under which one might expect to learn something about natural resources and their exploitation, can generally only become helpful if the often-evoked long-term perspective and interdisciplinary approach are systematically adopted. Despite interpretative problems these inform a debate about general trends in regional economic history better than the inert *tabulae* of natural resources offered by conventional Byzantine historical geography. The familiar 'tabular' approach can be useful (and it has its function in the present study: see section VI), but is only one element of the prerequisite framework.⁴⁹ Thus indications of the pre-Byzantine and post-Byzantine patterns of exploitation can be used to at least define investigative problems and models, as has been done tentatively by the *T.I.B.* for Cilicia and Isauria, whose authors point out the dearth of Byzantine references to the region's timber, a resource known to have been widely exploited both before and after the regions' Byzantine occupation-phases.⁵⁰ Regional studies which ignore these perspectives invariably have little to

47. See V. Beševliev, *Die protobulgarische Periode der bulgarischen Geschichte* (Amsterdam 1981) 1-4; *Hendy* 25 and 37-39. The plains and valleys of Bulgaria had also contained *saltus* in the Roman imperial era. Some examples are cited in B. Gerov, 'Aspekte des Grund- und Bondenbesitzes im römischen Thrakien und Moesien (1-3 Jh.)', *Ancient Bulgaria* 2, ed. A. Poulter (Nottingham 1983) 2-3.

48. Bozilova-Tonkov, *art. cit.*

49. Beševliev, *op. cit.*, 2-3, for instance offers a tabulation of ancient and Byzantine references to woodland in Bulgaria, given implicit meaning by the remark that such areas are now lightly wooded or bare, and by general references to charcoal-making and shipbuilding. The author makes no reference to palaeoenvironmental studies in Bulgaria. But most regional studies do not even reach Beševliev's position.

50. F. Hild-H. Hellenkemper, *Tabula Imperii Byzantini (T.I.B.) 5. Kilikien und Isaurien* (Vienna 1990) 111-5.

tell us about the history of Byzantine landscapes and land-use.⁵¹ Meanwhile historians who try to address the problem of the impact of the Byzantine exploitation of the woodland and scrubland of Anatolia in general are reduced to unhelpful generalisations by the lack of appropriate written sources.⁵²

It is worth citing one example of the corrective value of the new data for historians' general models. The historian Maurice Lombard, in his often-quoted study of the Muslims' predatory searches for timber around the coasts and islands of the Byzantine world, thought that he could detect a 'doubling' of the demand for timber with the arrival of the Muslims at the Mediterranean in the seventh century.⁵³ But this is a fluctuation not corroborated by the Greek and Anatolian environmental data. A

51. Monographs concerning Late Byzantine Epirus, Middle Byzantine Thessaly, Macedonia, Middle Byzantine Thrace, Later Byzantine Thrace, the Middle Byzantine Peloponnese, and Euboea, and the *T.I.B.* for Phrygia and Pisidia, Cappadocia, Hellas and Thessaly, do not analyse this basic aspect of Byzantine historical geography. An important study of the Middle Byzantine islands of the E.Mediterranean, E.Malamut, *Les îles de l'empire byzantin VIII^e-XII^e siècles* 1-II (Paris 1988), notes some references to woodland and scrubland and their exploitation without discussion. P.Soustal-J.Koder, *T.I.B. 3. Nikopolis und Kephallenia* (Vienna 1981) 233, offers without discussion one undated reference to the exportation of timber. The author of a new Byzantine historical topography of western and northern Macedonia evokes but does not seek to define the problem of the history of the exploitation of the regions' woodlands: V.Kravari, *Villes et villages de Macédoine occidentale* (Paris 1989) 28-29. Of course, I do not include *Paysages de Macédoine* in this category, nor A. Bryer-D. Winfield, *The Byzantine monuments and topography of the Pontos* (Dumbarton Oaks 1985), in which there is a useful discussion of the post-Byzantine situation (I, 299). I have not at this time been able to consult the very recently published *T.I.B.* for Thrace.

52. See J.Koder, *Der Lebensraum der Byzantiner. Historisch-geographischer Abriss ihres mittelalterlichen Staates im östlichen Mittelmeerraum* (Vienna 1984) 51-54, or HENDY 59-61.

53. M.Lombard, 'Arsenaux et bois de marine dans la Méditerranée musulmane VII^e-XI^e siècles', *idem, Espaces et réseaux du haut moyen âge* (Paris 1972) 110. This article (*op.cit.*, 107-151), though problematic in its use of Byzantine sources, remains the standard study of the literary sources for the Early Muslim exploitation of the timber-resources of the E. Mediterranean. It should be read together with the same author's 'La marine adriatique dans le cadre du moyen âge, VII^e-XI^e siècles', *op.cit.*, 95-105, and his 'Le bois dans la Méditerranée musulmane, VII^e-XI^e siècles. Un problème cartographié', *op.cit.*, 153-176.

rise in demand from Islamic Egypt in particular, and for Muslim and Byzantine warship-building, could have been more than offset by a slump in mercantile shipbuilding, in population-levels, and in construction of all kinds, in Anatolia, Greece, and the islands, during the seventh and eighth centuries.⁵⁴

The factors affecting the temporal fluctuations which have been revealed are those whose workings political and economic historians pursue in different spheres. Temporal fluctuations cannot be related to the operation of environmental factors in the medieval eastern Mediterranean. The current consensus is that climatic variability has within the last two and a half to three thousand years corresponded to that of recent centuries around the eastern Mediterranean; so that one does not, as some have done, seek to attribute environmental changes of the historical era to climatic events.⁵⁵ Regional variations meanwhile may more directly reflect the effect of broadly geographical factors

54. For some recent synthesizing approaches to the long-term material-cultural recession of this period see C.Mango, 'Daily life in Byzantium', *XVI. Internationaler Byzantinistenkongress. Akten I/1* (Vienna 1981) 337-353; C.Bouras, 'City and village: urban design and architecture', *op.cit.*, 611-653; A.Kazhdan, 'Moneta e società', *La cultura bizantina: oggetti e messaggio. Moneta ed economia* (Rome 1986) 203-236; W.Brandes, 'Die byzantinische Stadt Kleinasien im 7. und 8. Jahrhundert — ein Forschungsbericht', *Klio* 70 (1988) 176-208; *idem*, *Die Städte Kleinasien im 7. und 8. Jahrhundert* (Berliner Byzantinistische Arbeiten 56. Berlin 1989); J.F.Haldon, *Byzantium in the Seventh Century: the Transformation of a Culture* (Cambridge 1990), 92-124.

55. For the inappropriateness of Claudio Vita-Finzi's notorious general model of climatic-environmental change around the Mediterranean beginning in Late Antiquity see in general D.Davidson, 'Erosion in Greece during the first and second millennia B.C.', *Timescales in geomorphology*, edd. R.Cullingford et al. (Wiley-Interscience 1980) 143-158; J. Wagstaff, 'Buried assumptions: some problems in the interpretation of the "Younger Fill" raised by recent data from Greece', *Journal of Archaeological Science* 8 (1981) 247-264; S.Bottema, *art.cit.* n.23,276-7 (the absence of any palynological indicators of climatic change to accompany geomorphic events); Renfrew-Wagstaff, *An Island Polity* 92-3. A strong case for the continuity of the climatic regime is made by the S Argolid Exploration Project: see van Andel-Runnels-Pope, *art.cit.* n.31, 123-28, and Runnels-van Andel, *art.cit.* n.26. The Aegean Dendrochronology Project finds unequivocal evidence throughout Anatolia and the Balkans for a shared and consistent regime during the historical era. See P.Kuniholm, 'Aegean Dendrochronology Report. Expedition to Greece 1979-1980', *National Geographic Society Research Reports 1979-1980* (unpublished), 2-5; *idem*, 'Aegean

(accessibility of timber and the location of minerals; a local propensity to erosion) upon such temporal fluctuations.

One could read ten years ago that 'The history of Byzantine land clearing has yet to be written'.⁵⁶ Clearly though the real field of enquiry is economic history, particularly regional economic history. And although what landscape-studies can so far tell us about economic history is enigmatic, they are for Byzantinists a necessary instrument. Pollen-profiles may reveal few if any aspects of the exploitation of woodland and scrubland other than broad patterns of felling and clearance, but they inform the study of some overarching aspects of their exploitation in the Byzantine world (the trajectories, periodicity, and general geographical aspect of depletion and regeneration and its cyclicity or non-cyclicity), and thus provide one of the instruments with which the still purely qualitative models of changing levels of activity in the Byzantine economy, above all in the rural economy, may eventually be tested.⁵⁷ Meanwhile the phytogeographic and ethnographic projects mentioned above indicate the likely impacts of the major types of exploitation during the historical era. More regional studies are needed in which the decline and resurgence (or other patterns) of settlement-activity can be juxtaposed with palynological profiles. That at least is technically possible in some regions. Most of the profiles referred to in this discussion were not sought or examined within an archaeological and historical framework.

Dendrochronology Project. Spring 1982 Progress Report' (Cornell University, Department of Classics), 1; *idem* — C.Striker, 'Dendrochronological investigations in the Aegean and neighbouring regions, 1977-1982', *Journal of Field Archaeology* 10 (1983) 412-414. More recently initiated projects in historical geomorphology also find no evidence of climatic change in the historical era. See T.van Andel-E.Zangger, 'Landscape stability and destabilisation in the prehistory of Greece', *Man's role in the shaping of the Eastern Mediterranean landscape*, 139-57.

56. A.Kazhdan-G.Constable, *People and power in Byzantium: an Introduction to Modern Byzantine Studies* (Washington D.C. 1982) 49.

57. For the best such qualitative model see *Harvey*.

III

If it can be accepted that woodland and scrubland were extensive, not scarce, in most parts of the Byzantine world, including most of the semi-arid parts (where arborescent and non-arborescent scrubland was more typical than woodland), despite fluctuations in extent; that exploitation for subsistence was considerable but largely sustainable; that in aggregate exploitation-levels rose and fell in accordance to some extent with political, fiscal, and proprietorial conditions; conversely that recognisable changes in the level of afforestation do not reflect vague and unproven transformations of the E. Mediterranean climatic regime; and if the range and importance of exploitations can now be established too, then elements of a framework for a discussion of the political and proprietorial control of this sphere of activity will be in place.

Given the anecdotal nature of the Byzantine evidence, an outline of the range of exploitations can be little more than a descriptive exercise. Much of the evidence, Byzantine and related, can be conveniently tabulated, particularly that concerning arboreal extracts (see VI). The tabulated evidence is Late Antique (the Price Edict of Diocletian of 301 A.D., in Greek and Latin versions from Greece and Anatolia),⁵⁸ and Middle and Late Byzantine, supplemented by references to Frankish and Arab phases of regional occupation. It is necessary in fact to relate the Late Antique and later Byzantine references to ancient, Islamic, Frankish, and post-Byzantine, evidence, and to juxtapose Byzantine references of many types, so as to suggest, wherever possible, that however casual one reference may be it fits into a very long-term pattern of economic activities.

Every part of every tree or shrub, wild or cultivated, was useful in some way. Some sense of this can be gained from reading the *Geoponica*, the Byzantine agronomic work of the mid tenth cen-

58. See *Lauffer* 1, for the date.

tury.⁵⁹ The *Geoponica*, while having three of its twenty books devoted to trees and some shrubs, is in no sense systematic though, and is not concerned with that which has not been planted.⁶⁰ The detail of the range of uses is therefore better indicated by E. Mediterranean ethnography. But several forms of exploitation at source, corresponding to various kinds of primary products, can be clearly identified historically: felling (primarily for timber); the tapping of a range of resiniferous trees and shrubs; the gathering of wild parasites, crops, and leaves, from certain trees and shrubs as raw materials for tanning and dyeing and for a range of extracts; the stripping of bark for the same purposes; the pasture of pigs on the wild crops (pannage); and hunting. Another major form of exploitation, coppicing and pollarding, which is implicit in Byzantine references to rights to gather firewood in particular places, has been shown by fieldwork to have been practised in spontaneously occurring woodland and scrubland for centuries (see II). Clearance for agriculture or grazing does not concern us, but was of course a potentially gainful activity.

These are effectively the forms of exploitation. Beyond saying that they were considerable operations though, their size and profitability is, it goes without saying, not known for Byzantine Anatolia and S. Balkans. But it is worth considering the functional importance of the products and the evidence of their commercialisation.

Timber was a resource of particular importance for military and naval equipment and for 'strategic' reasons, and was the raw material for many elements of Byzantine architecture (except on the Anatolian plateau),⁶¹ for furniture,⁶² instruments, tableware,

59. See 'Geoponika', *The Oxford Dictionary of Byzantium* II, 834.

60. *Geoponica*, Books 9-11, Book 9 concerns the olive-tree.

61. See for instance C. Mango, *Byzantine architecture* (London 1986) 11-12, and 'Wood and Woodworking', *The Oxford Dictionary of Byzantium* III, 2204.

62. See for instance S. Goitein, *A Mediterranean society, the Jewish communities of the Arab world as portrayed in the documents of the Cairo Geniza I. Economic foundations* (University of California 1967), hereafter *Goitein*, 46, for the exporting of wooden chests, cupboards, and bedsteads, from Rum to Egypt in the Middle Byzantine period; and *Koukouless* II/A, 208, for professional wood-carvers.

and mechanisms,⁶³ and decor, both secular and religious.⁶⁴ Besides the physical evidence of the use of timber in surviving monuments there is a growing body of evidence in descriptions of properties, inventories, and wills.⁶⁵

The products of coppicing and pollarding (firewood, wood for charcoal-making, for light building materials, and also for leaf-fodder) represent another immensely important resource.⁶⁶ Arboreal resins had an enormous range of applications, in the preservation of all wood, and, together with arboreal gums, medicinal, dietary, and aromatic, applications.⁶⁷ In the era of natural dyes the importance of the wild arboreal crops, arboreal parasites, and leaves, used for dyeing cloth,⁶⁸ and the range of agents used for tanning and dyeing leather, including leaves, acorn-cups, bark, and tree-roots, from woodland and scrubland, is obvious.⁶⁹ From the leaves, shoots, seeds, and berries, of a

63. *Koukoulès II/A*, 197 and 198-9. For the commercialisation of wooden tableware in the late medieval Balkans see B. Cvetkova, *Vie économique des villes et ports balkaniques aux X^{VI}^e et X^{VII}^e siècles* (Paris 1971) 93 (Table 7).

64. See L.-A. Hunt, 'Byzantine woodwork', *The Macmillans Dictionary of Art* (forthcoming), which I am most grateful to the author for allowing me to read. See also 'Wood and Woodworking', *The Oxford Dictionary of Byzantium*.

65. See for instance the mentions of wooden fixtures in buildings in the inventory of the possessions of the monastery of Iveron: *Athos XVI. Iviron II*, no. 52 (1104), among many others the church whose narthex has some wooden pillars (ll. 189-90), the largely wooden building, an ἡλιακὸς (of a type which still existed in Macedonia at the beginning of this century, under the same name) (ll. 334-5), or the πύργος . . . πεντάπατος πεπατωμένος διὰ πατερῶν καὶ σανίδων πελεκητῶν καὶ περιφραγμένος ὁμοίως διὰ σανίδων (ll. 434-5).

66. The range of such products is documented by the Price Edict of 301, which regulates the prices of loads of various sizes of branches, stakes, and poles, and loads of woodchips and moss (*Diocletian* 14.1a and 7-12). See Meiggs 206, 246 and 263, for the practice of coppicing in Antiquity. For the ethnographic evidence of its importance see the works cited at n. 13. For leaf-fodder see VI: OAKTREE.

67. See VI: CEDAR, EUPHORBIA, FIR-TREE, GALBANE, JUNIPER, MASTIC, MASTICH-TREE, PINE-TREE, PITCH, RESIN, ΣΤΡΟΒΙΛΑΙΑ, STYRAX, TEREBINTH, TEPEBINΘINH, ΤΡΑΓΑΚΑΝΘΑ.

68. See VI: GALBANE, GALLS, OAK-TREE, ΠΙΝΟΚΟΚΚΙΟΝ, SUMACH, TEPEBINΘINH.

69. See VI: BARK, CAROB-TREE, GALLS, HOLLY OAK, HOLMOAK, SUMACH, TEPEBINΘINH.

range of trees and shrubs were also derived other medicinal, aromatic, dietary, fumigant, and cleansing, substances.⁷⁰ Pan-nage, so important for seasonal pig-fattening, is an exploitation recorded in Byzantine Macedonia, Anatolia, and Morea.⁷¹ Hunting and trapping too, whose importance in Byzantine culture has been well illustrated by Koukoules,⁷² were essentially practised in woodland and scrubland, and were universal subsistence-activities (see IV and V).

The importance of such products and activities is self-evident. And woodland- and scrubland-products were naturally highly tradeable.⁷³ A great many artisans will have depended upon them, or, put another way, upon the producers and their intermediaries: woodcutters and carpenters (ξύλουργοί, ματρικάριοι), timber-dealers (ξύλοπράται), charcoal-makers and sellers (άνθρακεῖς, καρβωνάριοι),⁷⁴ and upon those who actually created the whole range of arboreal extracts.⁷⁵ Towns in general depended upon traders for firewood.⁷⁶ And the state had a strong practical interest in the supply of timber, fuel, resins, and dyes, and a general fiscal interest in all exploitations of woodland and scrubland (for which see IV).

The commercialisation of the fundamental categories of arboreal products can be detected, and its regularity and considerable scale inferred, from the Arab geographers (the dearth of Byzantine references to this being almost as bad as that faced by Vryonis in his attempt to trace the continuity of mining through the Byzantine era). They refer explicitly to the exportation of

70. See VI: BAY-TREE, CAMEL'S THORN, CASTOR-TREE, CHASTE-TREE, CHRIST'S THORN, JUNIPER, SUMACH, TEPEBINÖINH, WORMWOOD.

71. See VI: CAROB-TREE, CHESTNUT, MAST.

72. See Koukoules V 387-423; Malamut, *Les îles de l'empire byzantin* II 433; D.Zakythinos, *Le despotat grec de Morée* II. *Vie et institutions* (London 1975) 246-7.

73. See evidence cited under entries in VI for products other than timber. For timber see the present section.

74. See Koukoules II/A 195 and II/B 207-8 and 213 for the producers and middlemen.

75. Of the makers of arboreal extracts we know next to nothing, but for the *masticharii* of Chios see IV and V.

76. See Meiggs as cited n.66 and the discussion of trade in the present section.

timber from Crete, Cyprus, and northern and western Syria, when these were under partial or total Muslim control.⁷⁷ By the 970s the Byzantine emperor, having reconquered all these places, could end this traffic, or rather redirect it, at the same time as he sought to control the movement of timber and its by-products throughout the empire (see below and IV). The evidence, ambiguous though it is, indicates (as will be seen) that the traffic was directed away from the Muslim world, but that the internal traffic of the Byzantine world was eventually left alone by the emperors. So although there are no obvious *Byzantine* references to the timber-trade of reconquered Cyprus, Crete, and Syria, or for the matter of the reconquered Taurus and Antitaurus, discontinuity of traffic should not be imagined. There is good evidence for the exportation of timber from Cyprus, Crete, Syria, and S.E. Anatolia in the later Middle Ages.⁷⁸ The trading of timber from N.E. Anatolia, to which references also only begin in the late Byzantine period,⁷⁹ is also most unlikely to have only begun then, given the evidence of early medieval shipbuilding (the evidence

77. See Lombard, 'Arsenaux et bois de marine . . .' (cited n.53) 114-8. Mango refers also to the importation of fifty trunks of pine and cedar from Cyprus to Jerusalem in the early ninth century for the restoration of the Anastasis Church: see his *Byzantine Architecture* 12. Cyprus was at this time a Byzantine-Muslim 'condominium'.

78. See for instance F.Thiriet, 'Problemi dell' amministrazione veneziana nella Romania XIV-XV sec.', *Venezia e il Levante fino al sec. XV* (Florence 1973) 778; *idem*, 'Candie, grande place marchande dans la première moitié du XV^e siècle', *Κρητικά Χρονικά* 15 (1963) 342 (for Crete); D.Tsougarakis, *Byzantine Crete from the 5th century to the Venetian Conquest* (Athens 1988) 275-6 (for Crete); P.Racine, 'Marchands placentins à l'Aïas à la fin du XIII^e siècle', *BF* 4 (1972) 201 (for SE Anatolia); Francesco Pegolotti, *La pratica della mercatura*, ed. A.Evans (Cambridge Mass. 1936) 86 (for Cyprus).

79. M.Balard, *La Romanie génoise (XIII^e — début du XV^e siècle)* (École française de Rome 1978) 851; P.Strässle, *Der internationale Schwartzmeerhandel und Konstantinopel 1261-1484 im Spiegel der sowjetischen Forschung* (Bern 1990) 122 and IV, n.158.

again is Arabic).⁸⁰ The same is probably true for the Albanian coast.⁸¹

The regionally specific record is very much a function then of the survival of evidence of western commercial penetration in the later Middle Ages. Only in Macedonia, for which there is more Middle Byzantine archival material than for other E. Mediterranean regions, can one glimpse the Byzantine timber-trade prior to western penetration. In 972 the emperor John I had forbidden the traffic in firewood (δάδια) from the Athos peninsula.⁸² Firewood is very often the by-product of felling and logging. This is clearer in the imperial regulations for the Athonite communities of the year 1045, which refer to the monasteries' exploitation and sale of ξύλον ἐργάσιμον καὶ σανίδια καὶ δάδας καὶ πίσσαν ('timber and planks and firewood and pitch').⁸³ The monks' vessels certainly traded as far as Thessalonica, Ainos, and Constantinople, and each community will have had its *xylokopeion*, like the one recorded in 1089.⁸⁴ The later Macedonian evidence, such as it is, conforms to the pattern of other regions of the Byzantine world: a reference to the exportation of timber (*lignamen*) by Latins in 1278.⁸⁵

80. *La géographie d'Edrisi*, ed. P.-A. Jaubert, II (Paris 1840) 393: Idrisi, referring to 'Lanio' on the Pontic coast between Sinope and Kerasous, in 'Laz' country, identified by Jaubert with Ünye, Byzantine *Oinaion*, writes 'On y construit des navires et embarcations de guerre'. Idrisi wrote in the twelfth century and culled much of his information from earlier Arab geographers. But it remains basically a Middle Byzantine reference. For Byzantine *Oinaion* and its 'heavily wooded' hinterland see A. Bryer-D. Winfield, *The Byzantine Monuments and Topography of the Pontus* (Washington D.C. 1985) 101 onwards.

81. See A. Ducellier, *La façade maritime de l'Albanie au moyen âge* (Thessalonike 1981) 60, for the evidence of the thirteenth and fourteenth centuries. See also B. Krekić, *Dubrovnik (Raguse) et le Levant au moyen âge* (Paris 1961) 108 n.5.

82. *Athos VII. Prôtaton*, no.7 (972) ll. 139-40.

83. *Op.cit.*, no.8 (1045) ll. 102-3.

84. *Op.cit.*, no.8, ll. 60-7 and 99-101 for the directions of maritime traffic. A *xylokopeion* is mentioned in a delimitation of boundaries on Mount Athos: *Athos XV. Xenophon*, no.1 (1089) l. 135.

85. G. Tafel-G. Thomas, *Urkunden zur älteren Handels- und Staatsgeschichte der Republik Venedig mit besonderer Beziehung auf Byzanz und die Levante*, III (Vienna 1856) 278: the ship concerned was sailing 'de Saloniche' when robbed at sea by Greeks.

Quite apart from the special needs of artisans (particularly for charcoal),⁸⁶ the supply of urban populations with fuel (firewood and charcoal) will always have been commercially worthwhile. Wood is described as one of the four necessities which the villagers brought to the urban markets of S.W. Anatolia in the Life of St Nicolas of Sion in the late sixth century.⁸⁷ Its profitability, organisation, and importance, in classical Greece and Roman Italy have been recently discussed.⁸⁸ The fuels are listed in the Price Edict of 301.⁸⁹ It was clearly profitable for the monasteries of Athos to take firewood by sea, perhaps not only from Athos but also from their estates in other wooded parts of the Khalkidike, to urban markets. Thessalonica was still being supplied with wood from the southern Khalkidike by sea in the mid nineteenth century.⁹⁰ It is possible that the market for firewood (*legna da ardere*) which Francesco Pegolotti noted at the port of Rhodes in the early fourteenth century, around the time of its seizure from the Byzantine state, both supplied and was fed by a maritime traffic.⁹¹ The scale of such operations has been demonstrated by ethnographers for small rural communities. Urban data however is problematic. The Genoese city-government of Pera, opposite Constantinople, bought 25000 *cantares* of wood in 1390 and 1391 for fuel and housebuilding.⁹² This is only about 340 tons however.⁹³ If a traditional rural community in southern Greece

86. See Koukoulès II/A 195 and 217-8, and IV 441.

87. See Harrison, *art. cit.* n.36,226 (quoting the *vita* of St. Nicolas of Sion cap.52), the four necessities there being wood, wheat, flour and wine.

88. See Meiggs as cited n.66. See also S.Olson, 'Firewood and charcoal in classical Athens', *Hesperia* 60 (1991) 411-420, particularly 415-419 for the supply of cities as an entrepreneurial operation.

89. See note 66 above.

90. See for instance H.Tozer, *The islands of the Aegean* (Oxford 1890) 279: near the southern cape of Pallene (the Kassandra Peninsula) 'a vessel was lying in readiness to carry timber to Salonica'. Tozer visited Athos in 1861 (*op. cit.*, 280) and Thessalonica in 1865 (*op. cit.*, 277).

91. Pegolotti, *La pratica della mercatura*, 104. For Pegolotti's assemblage of data over the years ca. 1310-1340 see Evans' introduction xii-xv.

92. Balard, *La Romanie génoise*, 390.

93. See F.Thiriet, *Régestes des délibérations du sénat de Venise concernant la Romanie I* (Paris 1958) 228 for the *cantare*.

used about 735 tons of firewood in one year,⁹⁴ then the *officiales electi ad emendum ligna (sic)* of Pera were only paying for a fraction of the community's needs for fuel.

The commercialisation of most arboreal extracts was also, like that of timber, firewood, and charcoal, probably ubiquitous. Most extracts were essential items in pre-industrial societies such as Byzantium. Some of course were luxuries. The parts of the Byzantine world with which we are concerned were the sources of many essential and 'luxurious' extracts which could not be produced in temperate Europe.⁹⁵ We are therefore dealing with products sought both within and beyond the Byzantine world.

The Price Edict of 301, in which most major arboreal products are mentioned, does specify some geographical sources, mostly of items that could not be found everywhere: for the mastic and natural turpentine of Chios, for a particular quality of resin or pitch from Phrygia, for storax of Cilicia and Syria, for Pontic wormwood and castor oil.⁹⁶ Besides Anatolian and Aegean places of origin, the region which emerges as a major source of long-distance trade in timber, arboreal extracts, and the raw materials whence these come, is Syria.⁹⁷ Incoming Syrian merchants even merit a special mention in the early tenth-century Book of the Eparch,⁹⁸ the only non-Byzantine group (as they were at that time) to do so. They are those associated with the importation of *μυρεψικά* and *βαφικά*, literally 'aromatic' substances and dyes.⁹⁹ *Myrepsika* however had a broader meaning in Byzantine Greek, referring to most of the extracts mentioned in this

94. See Forbes-Koster *art.cit.* n.13,121 (Table 5).

95. See O.Polunin, *Trees and bushes of Europe* (Oxford 1976), hereafter *Polunin*, under entries for individual trees and shrubs.

96. Castor-tree oil (*Aezani* 34.76-77; Mastic (*Diocletian* 36.63; *Aezani* 34.17); terebinthinae (*Diocletian* 36.127-8); resin or pitch (*Diocletian* 36.130; *Aezani* 34.76-7); storax (*Diocletian* 36.57-8); wormwood (*Aezani* 34.19).

97. Syria is recorded as the source of cedar-wood, galbane, galls, styrax, sumach, terebinth-products and tragacanth (see VI).

98. For an origin *ca.* 911-12 see *Das Eparchenbuch Leons des Weisen*, ed. J.Koder (CFHB 32, Vienna 1991), hereafter *Eparch*, 31-2.

99. *Eparch* 5.4.

section.¹⁰⁰ A range of these regionally occurring substances are recorded being exported from Syria both before and after the Byzantine reconquest of the arboriferous parts of Syria in the mid tenth century. So although the Book of the Eparch names only the most exotic substances, which really came from the Arabian peninsula, Palestine, India and beyond, its non-specific reference to others, the *myrepsika* and *vaphika*, should refer in practice to many of Syria's traditional arboreal products.¹⁰¹

IV

Strategic, logistic, and fiscal, considerations ensured that the Byzantine state took some interest in the exploitation of arboreal resources, quite apart from the general fiscal interest which it took in the circulation and exchange of products, arboreal and other.

The strategic consideration, the conservation of timber suitable for warship-construction and other public uses, and denial of access to hostile powers, was both an ancient one and a concern of western medieval rulers.¹⁰² The early Islamic states' quest for timber around the southern parts of the Middle Byzantine empire has already been mentioned.¹⁰³ An element of the Byzantine response, the establishment of the 'maritime provinces', whose inhabitants' tax-burden was characterised by its orientation towards the needs of the fleet, in effect the needs of provincial fleets, has been closely examined by Byzantinists.¹⁰⁴ These Mid-

100. See *Koukoulès* II/A 205-7.

101. See n.97 for the principal recorded arboreal exports of medieval Syria. See *Eparch* 10.1 for the itemised products (non-Syrian).

102. See for instance *Meiggs* 85-6 for Antiquity. For the early medieval west see Wickham, *art.cit.* n.19, 524-5.

103. See Lombard, *art.cit.* n.53, particularly 134-8.

104. Principally H.Ahrweiler, 'Fonctionnaires et bureaux maritimes à Byzance', *REB* 31 (1961) 239-52; *eadem*, *Byzance et la mer. La marine de guerre, la politique, et les institutions maritimes de Byzance aux VII^e-XV^e siècles* (Paris 1966); for late seventh-century arrangements, H.Antoniadis-Bibicou, *Études d'histoire maritime de Byzance à propos du thème des Caravisiens* (Paris 1966); and now for the main developments, Malamut, *Les îles de l'empire byzantin*, I 296-334 (and maps 644-6).

dle Byzantine provinces covered much of the south coast of Asia Minor and most if not all of the Aegean islands. Within the Aegean the circumscriptions were frequently altered for reasons that are not clear, but these maritime or fleet-building provinces will always have had among their functions that of the strategic protection of the timber-resources of those regions against the Islamic states.

Strategic considerations also affected imperial subjects' access to timber and freedom to dispose of their own timber. The emperors of the ninth and tenth centuries, certainly from the reign of Leo V, at the time of the Arab conquest of Crete, forbade the sale of timber to the Muslims.¹⁰⁵ The state's requirements and the need to deny access to aggressors gave it two reasons for seeking to control felling and the timber-trade. Such thinking would explain the emperor Constantine IX's insertion of a general ban on the sale of timber, boards, and pitch, by the monasteries of Mount Athos into the *Typikon* of 1045, better than the ostensible reason given, that the monks should be devoting themselves to their prayers and oraisons.¹⁰⁶ The ban concerns precisely the arboreal products which the state is later shown, through requests for and grants of immunity from provision, to have nonetheless sought for imperial fleets (v.i.).

Not that it was the Islamic states that seemed to pose a threat in the mid eleventh century, but Kievan Russia, whose fleet appeared in the Bosphorus in 1043 and which Constantine IX could not at that moment confront effectively. Besides the need for a new Constantinopolitan fleet, there had also been a considerable naval commitment to campaigns in southern Italy and Sicily, and there is evidence of a naval squadron active in the northern Aegean at this time.¹⁰⁷ So Constantine, by attempting to control felling and production for the market, was perhaps trying to ad-

105. See Lombard, *art.cit.* n.53,133-4.

106. *Athos VIII. Prôtaton*, no.8 (1045) ll. 102-3, where it is stated that the trade existed: ἐξάγουσί τινες τῶν μοναχῶν ἀπὸ τοῦ Ὄρους διὰ πλοίων καὶ ἀπεμπολοῦσι ταῦτα.

107. Ahrweiler, *Byzance et la mer*, 122-9.

dress the needs implied by these circumstances. The environmental evidence that felling was beginning to overtake regeneration in Greece and Anatolia from the ninth century onwards (v.s.) is perhaps also relevant.

As there is no evidence of attempts to perpetuate Constantine IX's ban, we may assume that, as regards the empire's internal traffic, it lapsed. But the export-ban of the ninth and tenth centuries was probably still enforced. It is significant that timber does not appear among western merchants' exports from the Byzantine world before the upheavals of the early thirteenth century.¹⁰⁸ Emperors moreover could still exert direct control over woodlands and scrublands which were imperial properties. The wardens of imperial woodland can be identified in a document of the year 1073.¹⁰⁹ And Niketas Choniates, recounting the approach of the Franks and Venetians in 1202-1203, castigates the wardens (οἱ . . . περιφύτων ὁρῶν φύλακες) for preventing anyone from cutting timber for shipbuilding (τοῖς ἐκτεμεῖν προθεμένοις ἐκεῖθεν ξύλα ἅττα ναυπηγήσιμα).¹¹⁰ Normally though these *phylakes* were only carrying out their duties in this respect. They could be seen as the heirs of the Roman *saltuarii*.¹¹¹

108. See R.-J. Lilie, *Handel und Politik zwischen dem byzantinischen Reich und den italienischen Kommunen Venedig, Pisa und Genua in der Epoche der Komnenen und der Angeloι (1081-1204)* (Amsterdam 1984) 264-84 ('Die Handelsobjekte'). The Venetians were exporting central European timber to Egypt (*op.cit.* 266). But their exportation of Cretan timber begins shortly after the division of the Byzantine empire in 1204: Tsougarakis, *Byzantine Crete from the 5th century to the Venetian conquest* 275.

109. See *Βυζαντινά έγγραφα της μονής Πάτμου Β' — δημοσίων λειτουργῶν*, ed. M. Nystazopoulou-Pelekidou (Athens 1980), hereafter *Palmos* II, no. 50 (1073) ll. 151, 152. Imperial estates in W Asia Minor, charges for the exploitation of which indicate that they contained much woodland and scrubland (see V), were controlled by ὁροφύλακες. But an examination of the photographs of the document confirms that the scribe put rough breathings for smooth all too frequently (ἐννόμιον τοῦ ὁρους, ἴσοδος . . .). I would therefore read ὁροφύλαξ, just as one must read ὁρους. *Orophylax* recalls the woodland-charge of *orokopion*, for which see n. 128.

110. *Nicetae Choniatae Historia*, ed. J. van Dieten (Berlin 1975) 540 l. 47-541 l. 1.

111. See Meiggs 330 for the *saltuarii*.

A strategic policy towards timber was perhaps maintained by the emperors of Nicaea in the thirteenth century, who built and maintained fleets in the Aegean and the Sea of Marmora.¹¹² Their economic protectionism is documented in other ways.¹¹³ But there is no trace of a general policy operating after the late thirteenth century, when Michael VIII gave the Venetians permission to buy whatever they needed for shipbuilding,¹¹⁴ and Andronikos II effectively scuppered the Byzantine fleet.¹¹⁵ His officials did in 1319 prevent the Venetians from exporting a shipload of wood from Thessalonica.¹¹⁶ But although the successors of Andronikos II maintained naval squadrons there is no further trace of interference with the timber-trade until immediately after the Ottoman conquest of Constantinople.¹¹⁷

The abandonment of a strategic perspective does not mean that the Byzantine state ever lost its logistic interest in the supply of timber and other arboreal products — a supply which could be met by several means, using as already indicated for Athos, the resources of landowners, besides of course the resources of imperial properties. The problem is that of the history of the Byzantine state's various fiscal and economic instruments of acquisi-

112. For the Nicaean fleet see Ahrweiler, *Byzance et la mer* 304 onwards, and M. Angold, *A Byzantine government in exile. Government and Society under the Laskarids of Nicaea (1204-1261)* (Oxford 1975) 196-201.

113. Angold, *op.cit.* 116 onwards.

114. See Ahrweiler, *op.cit.*, 426-7 for this concession.

115. Ahrweiler, *op.cit.*, 376 onwards; D. Nicol, *The last centuries of Byzantium 1261-1453* (London 1972) 114-15.

116. K. Mertziós, *Μνημεία μακεδονικής ιστορίας* (Thessalonike 1947) 20-21, summarising an entry in the Venetian *Commemoriali*. For the nature of this archive see briefly F. Thiriet, *La Romanie vénitienne au moyen âge* (Paris 1959) 21. Andronikos II attempted to assert or re-assert other exporting restrictions which remind one of imperial monopolies, for instance upon salt and mastic: see J. Chrysostomides, 'Venetian commercial privileges under the Palaeologi', *Studi veneziani* 12 (1970) 273.

117. See F. Thiriet, *Régestes des délibérations du sénat de Venise concernant la Romanie* III (Paris 1961) no. 2994 (1455), summarising a document to be found in H. Noiret, *Documents pour servir à l'histoire de la Crète sous la domination vénitienne 1380-1485* (Paris 1892) 444: 'inde (Constantinople) deferebatur huc (Crete) maxima copia lignaminis dogarum', a trade then banned.

tion and of whether and when the balance may have shifted among them.

The *Codex Theodosianus* includes decrees of the late fourth century partially exempting private estates from levies of timber and cut boards, and of charcoal-production.¹¹⁸ The Early Byzantine state was also a considerable owner of woodland and scrubland in its own right.¹¹⁹ It needed large quantities of timber and fuel for shipbuilding, for the mints, for the armourers' forges, for the *cursus publicus*, for mines and public works, for the army and the *palatium*. The levies being reduced in the Theodosian Code are the *sordida munera*, uncompensated levies in kind, in other words *corvées*.¹²⁰

The Middle Byzantine state's needs were almost identical, as grants of immunity from various charges show. It too, at any one time, held very extensive properties on a number of accounts for the crown and the fisc.¹²¹

Perhaps the timber-requirements of the Middle Byzantine provincial fleets of the Aegean and southern Anatolia could be met by ships' crews felling trees in imperial forests within those pro-

118. *CTh.* xi, 16.15; xi, 16.18 (*Theodosiani Libri XVI cum Constitutionibus Sirmondianis*, ed. Th. Mommsen, P. Meyer et al. [Berlin 1905]; Eng. transl. C. Pharr et al., *The Theodosian Code and Novels and the Sirmondian Constitutions*, [Princeton 1952] 11.16.15 [A.D. 382] and 11.16.18 [A.D. 390]).

119. See A. H. M. Jones, *The Later Roman Empire 284-602: a social, economic and administrative survey*, II (Oxford 1964) 788-9, and Hendy 637-8, for the scale of imperial possessions. See *CTh.* v, 12.2; v, 13; v, 14.31 and vii.7.2, for the leasing of imperial *saltus* (woodland/scrubland-pasture) and farmland.

120. The needs of the mints and armourers are mentioned in the imperial concession of the year A.D. 382. See Meiggs 258-9 for evidence of emperors' assumption of responsibility in Late Antiquity for organising the fuel-supply of the public baths of Rome. The needs of the fleet, public works, and *Cursus Publicus* were also certainly, mines and the fuel-supply of Constantinople probably, imperial responsibilities. For indications of the *Cursus*' own arboreal needs see Jones, *op.cit.*, 833 and for the status of mines 838.

121. See Ahrweiler, *Byzance et la mer* 141-2 and 147, n.1 for their support of provincial forces; Hendy 87-90 for the Balkans, and 104 and 106 for Eastern Anatolia and Syria; N. Oikonomides, 'L'organisation de la frontière orientale de Byzance aux X^e-XI^e siècles et le Taktikon de l'Escorial', *Actes du XIV^e congrès international des études byzantines*, I (Bucharest 1974) 300 for the eastern frontier.

vines. This is the practise revealed by the emperor Constantine VII when he describes arrangements made at the time of his expedition against Muslim-held Crete in the year 943. Three ships' companies were left behind in the two regions to cut the wood required for the coming fiscal year (εἰς τὸ κόψαι τὴν τῆς ὀγδότης ἰνδικτίονος ξυλὴν).¹²² But the Middle Byzantine state clearly also retained its predecessor's right to levy arboreal products from the properties of individuals and communities, impositions included under the general headings of ἀγγαρεῖαι or ἐπηρεῖαι.¹²³ These impositions, as revealed by grants of immunity therefrom, could be serious: the felling and transportation of wood (κοπῆς καὶ καταβιβασμοῦ οἰασδήτινος ξυλῆς vel sim.),¹²⁴ the provision of sawn planks (πρίσεως σανίδων),¹²⁵ the construction of warships and other vessels (καραβοποιίας, κατεργοκτισίας, and specified types of vessel),¹²⁶ and the provision of pitch,¹²⁷ and charcoal (variously παροχῆς and καύσεως καρβῶνων).¹²⁸ Such

122. *Constantini Porphyrogeniti imperatoris De Cerimoniis Aulae Byzantinae*, ed. J. Reiske, I (Bonn 1829) 665. This illustrates the special nature of the marine *strateia*. The 'eighth indication' refers, of course, to the eighth year of the fifteen-year indictional cycle.

123. For the general applicability of these rights (barring specifically exempted groups), in theory assessed according to fiscal ratings, see A. Stavridou-Zaphraka, 'Ἡ ἀγγαρεία στο βυζάντιο', *Βυζαντινά* 11 (1982) 36-8 and 40-1 (early and middle Byzantine evidence), where also evidence of the exploitation of imperial properties. These rights could affect any sphere of economic activity.

124. *Athos V. Lavra I*, no. 48 (1086) l. 42; *Βυζαντινά έγγραφα τῆς μονῆς Πάτμου Ἀΐ- αυτοκρατορικά*, ed. E. Vranouse (Athens 1980), hereafter *Patmos I*, no. 6 (1088) l. 56; *Lavra I*, no. 51 (1092), ll. 11-12; *MM IV*, no. 1 (1228) 4 (Lembos); *MM IV*, no. 2 (1235) 17 (Lembos).

125. *Lavra I*, no. 48 (1086) ll. 42-3; *Patmos I*, no. 6 (1088) ll. 57-8. There is also the obscure provision στραβοξυλῆς, which it has been proposed means the planking of the lower hull (*Ducange*, s.v.): *Patmos I*, no. 7 (1088) l. 22; *Patmos I*, no. 8 (1119) l. 7; *Patmos I*, no. 11 (1197) l. 25. Its continued appearance among immunities throughout the twelfth century is interesting.

126. *Lavra I*, no. 48 (1086) l. 43; *Patmos I*, no. 6 (1088) l. 57; *MM IV*, no. 1 (1228) 4; *MM IV*, no. 2 (1235) 17.

127. *MM IV*, nos. 1 and 2 as cited above.

128. *Lavra I*, no. 51 (1092) l. 12; *MM IV*, nos. 1 and 2 as cited above. See J. Haldon, *Byzantine Praetorians* (Bonn 1984) n. 978 for the levying of charcoal from estates and for the clearly related levying of iron (presumably as ore).

levies would have supplied the needs of fleets, and also armies and garrisons, some of whose needs are spelt out in a Middle Byzantine military treatise.¹²⁹

The Late Byzantine state retained a right to such services, as evidence from Macedonia and the Peloponnese shows.¹³⁰ Among specific impositions the most burdensome, *κατεργοκτισία/κτίσις κατέργων*, is listed as an immunity in chrysobulls of 1280-81 and 1298,¹³¹ and a levy of wood and fodder, the *ξύλαχυρον*, which was probably for troops, is itemised in 1332 (and in later Serbian documents concerning S.E. Macedonia).¹³² But these specific late references are so rare that one can conclude that the emphasis among the various instruments of acquisition had finally shifted.

In fact, while pure *corvée* could be and was practised,¹³³ the same term, *angareia*, had long been applied also to obligatory paid work, hire, and sale to the state.¹³⁴ The state's means of meeting its needs in the respects which concern us were undoubtedly varied at all times. The emperor Constantine VII who used a kind of *militia* for timber-felling, refers both to the requisitioning of pitch and to the purchase in large quantities of liquid pitch, 'pitch' (presumably hard pitch), and cedar-oil or resin, for his

129. That the army needed pitch, timber, and firewood is stressed by a middle Byzantine military treatise: see *Three Byzantine Military Treatises*, ed. G. Dennis (Washington, D.C. 1985) 63.63; 30.14 and 26.9-10, for each of these items respectively. The commercialisation of firewood from the Athos Peninsula was forbidden by John I in 972 (*Prôtaton*, no.7, ll. 139-40) and by Constantine IX in 1045 (*Prôtaton*, no.8, ll. 102-3).

130. See Stavridou-Zaphraka, *art.cit.* n.123,33,34,37 and nn.72-3,80 and 98.

131. *Athos XIII. Docheiariou*, no.9 (1280/1) l. 40; *Athos VIII. Lavra II*, no.89 (1298) l. 162 onwards. This immunity is also listed in a chrysobull of the Tsar Stefan Dušan: *Athos VI. Esphigménou*, no.24 (1347) l. 31.

132. For examples of immunity from the *xylakhyron* see *Esphigménou*, no.23 (1347) l. 31 and *Les archives de Saint-Jean-Prodrome sur le mont Ménécée*, ed. A. Guillou (Paris 1955), no.26 (1332) l. 67; *Athos XV. Xénophon*, no.29 (1352) l.20; in fact in only one instance a Byzantine document (that of 1332).

133. Stavridou-Zaphraka, *art.cit.* n.123, *passim*.

134. Stavridou-Zaphraka, *art.cit.* n.123,30 and n.57 (early and middle Byzantine evidence).

Cretan expedition of 943.¹³⁵ A Middle Byzantine military treatise refers to the practice of hiring wood-bearers.¹³⁶ And fiscal commutation of demands was always a possibility for some.¹³⁷

But the frequent itemisation of such demands for raw materials, products, and equipment, among immunities from the eleventh century onwards, instead of the earlier generalised immunity from *angareiai*, suggests the continued extraction of materials and labour rather than the commutation which had by this date affected service (*στρατεία*, service in lieu of certain taxes) in the provincial forces, including the marine, and which had also affected the *strateia* of the upkeep of the *dromos* (the Middle Byzantine *cursus publicus*).¹³⁸ This might at first seem contradictory but is not.

Contrary to the suggestion (for that is all it is) that the comprehensiveness of lists of exemptions from such impositions is somehow connected with their simple commutation,¹³⁹ it is more reasonable to connect them with a geographically wider application of the appropriation of materials and labour following the demise of naval construction and provisions as elements of the *strateiai* of particular provinces in the mid eleventh century,¹⁴⁰ and the demise of the *dromos* as *cursus* in the second half of that century.¹⁴¹ The question of the form of appropriation remains

135. *De Cerimoniis*, I 673 and 677.

136. *Three Byzantine Military Treatises*, 10 l. 14 and 18 l. 98.

137. Stavridou-Zaphraka, *art.cit.* n.123,30 and 50-2.

138. For the fiscalisation of all these services in the eleventh century see now Harvey 110-13. For the *cursus publicus* see Jones, *Later Roman Empire* 830-4; for the succession *cursus-dromos* see now Hendy 294-6. For enrolment in the service of the *dromos* (as for the *cursus*) as involving a separate fiscal group see now Stavridou-Zaphraka, *art.cit.* n.123,44 and nn.135 and 138-9. For the provincial maritime *strateia* see Ahrweiler, *Byzance et la mer* 109.

139. Harvey 113.

140. Ahrweiler, *Byzance et la mer* 134-5.

141. Its absence from Byzantine archives after 1060 has been noted: A. Harvey, 'Peasant categories in the tenth and eleventh centuries', *BMGS* 14 (1990) 255. The Anatolian *dromos* could not have survived the upheavals of the 1070s (for its network see Hendy 609 onwards). Laurent can argue on the basis of the sigillographic record

open. Would Constantine IX have requisitioned the arboreal resources of Athos or compulsorily purchased them? The growth of trade, whose interference with supplies Constantine IX sought to lessen, might have induced emperors to pay something for the products. What form however might Alexios I have preferred when in 1099 he 'commanded from all the provinces under the authority of the Romans that ships be built'?¹⁴² A century later the variety of the means by which the state continued to acquire the arboreal materials, products, and equipment which it required is indicated by the archbishop of Athens Michael Choniates' famous address to the emperor Alexios III, which distinguishes between the imposition of ship-construction *and* the fiscal penalties for not fulfilling this *and* the fiscal charges for maintaining crews, marines, etc. Different officials are concerned with the different operations, and there is almost certainly a revived form of *strateia* involved (by whatever name), at least in the province of Hellas-Peloponnesos.¹⁴³ Fiscal commutation could presumably offer no guarantee of provision in an era of growing competition for resources and labour, an era of economic growth as it is now recognised to have been.

A combination of extractive instruments is suggested by further practical considerations. The most effective way to take advantage of marketable artisanal skills (e.g., of carpenters, ship-

that the *dromos* as *cursus* did not survive the eleventh century: V. Laurent, *Le corpus des sceaux de l'empire byzantin* II (Paris 1981) 195. Other administrative functions still came under this heading though. See Stavridou-Zaphraka, *art. cit.* n.123,44 and n.135 for the wide application in the middle and late eleventh century, whatever the form, of the ἐνοχὴ τοῦ δρόμου or simply δρόμος.

142. Anna Comnène. *Aléxiade*, ed. B. Leib, III (Paris 1945) 42; Ahrweiler, *Byzance et la mer* 192-3.

143. Καὶ μαρτυρεῖ τὸ προσέχως παρελθὼν ἔτος ὅτε κτίσεως κατέργων ὀρισθείσης ἡμεῖς πρῶτοι καὶ μόνοι τῶν ἄλλων, καίπερ μὴ κτισθέντων, ἐξημιώθημεν, ὅτε τοῦ Πανσίου Στεριόνου (the admiral) καταπεπλευκὸς μόνοι ἡμεῖς νομίσματα (*vacat*) ὑπὲρ πλωϊμῶν κατεβαλόμεθα: *Μιχαὴλ Ἀκομινάτου τοῦ Χωνιάτου τα σωζόμενα*, ed. S. Lampros, I (Athens 1879) 308. See *ibid.* II (Athens 1880) 106 for the different ἐπιρραστής, κτίστας κατέργων, πλωϊμολόγους. For the Comnenian re-assignment to Hellas-Peloponnesos of the tasks of the building and provision of fleets, see Ahrweiler, *Byzance et la mer* 275-9 and 265 for Euboea in particular.

wrights, caulkers) was to impose duties in exchange for tax-concessions. The dislocation, physical and economic, of activities such as the felling and transportation of timber, the κοπή καὶ καταβιβασμός of the archives (which in places involved the floating of timber down rivers, an activity recorded in the twelfth century by archbishop Eustathios of Thessalonica),¹⁴⁴ might on the other hand have required the hiring of labour. The less serious the disruption, the more likely the application of unpaid *angareia*. If unskilled labour was needed and available on imperial (as opposed to private) estates, the historically attested unpaid and uncommuted *angareia* is all the more likely. The variety of means whereby the state continued to meet its material needs fits after all into a larger pattern. For instance military service could be performed by some in exchange for the concession for life of either revenues or lands while taxation paid the wages of others.¹⁴⁵

It should therefore come as no surprise if the replacement of some tax-obligations for registered groups by the provision of materials and products were continued after the twelfth century. Such services constituted one of several possible ways for the state to connect the fulfilment of its needs with the resources at its disposal. The Late Byzantine state made no general attempt to prevent the acquisition by westerners of timber (v.s.). But documents of the late fourteenth century from Chios suggest that the Genoese inherited from the Palaiologoi in the mid fourteenth century¹⁴⁶ a pre-emptive system for the acquisition of boards and pitch offset against some taxes, in other words the basic materials for shipbuilding. And it will be remembered that the

144. *Eustathii archiepiscopi thessalonicensis commentarii ad Homer. Iliadem*, ed. M. van der Valk, III (Leiden 1979) 241 ll. 3-8. See Meiggs 336 for Antiquity. Floating is practicable, among other places, on some rivers of S Anatolia: see Lombard, *art.cit.* n.53, 108.

145. For the twelfth and thirteenth centuries see for convenience still Ahrweiler, *Byzance et la mer* 218-222. For the mid-thirteenth century onwards see now M. Bartusis, *The Late Byzantine Soldier: a social and administrative Study* (Ph.D., Rutgers University 1984) 465-87.

146. As late as 1349 Chios was still under partial Byzantine control, a situation which could not have outlasted the Byzantine-Genoese confrontation of 1351. See Nicol, *The Last Centuries of Byzantium* 234, and 243 onwards.

Palaiologoi had retained the right to impose shipbuilding.

A report of the podestà of Chios from 1395 states that the *angaria* of 2 *perperi* per household or hearth is payed by the Greeks *exceptis masticariis et marinariis galee ac laborantibus tabulas et picem*. Of these groups the board- and pitch-makers payed instead a *commerchium* and were excused the night-watchmanship, 'and it was always so'.¹⁴⁷ The *masticarii* were concerned with an imperial commercial monopoly which the Genoese inherited (see V), while the privileged mariners were perhaps the crews of fighting ships. The other two groups, also called respectively *tabularii* or *samdarii* (perhaps from σάνιδιον, 'board', whence *σανιδάριος),¹⁴⁸ and *pexarii/piciarii*,¹⁴⁹ were at this time registered on special rolls.¹⁵⁰ A document from 1394 concerns the quantities of pitch to be supplied each year by those enrolled to the *commertiarus/emptores commertii picis*, the number of months (for some workers the whole year) during which they must produce for the authorities, and a ban on the sale to unauthorised *collectores*.¹⁵¹ Though no Byzantine document of this kind, at least of the Middle and Late period, has survived the crucial terms used in the Genoese documents (*angaria*, *commerchium*, *commertiarus*) are of Byzantine origin, the arrangements are described as of long standing (*et semper fuit*), and they fit well with the Byzantine tendency to use a variety of instruments to meet the needs of the state, as here a combination of commutation (of the *angaria*), uncommuted labour, and enforced sale. They indicate the kinds of arrangements which the Byzantine administration had to make to meet its material needs.

147. P. Argenti, *The occupation of Chios by the Genoese and their administration of the island 1346-1566 II. Codex and documents* (Cambridge 1958) 145-7 (from a dossier containing a report by Nicolò Fatinati, Podestà, to the Doge, concerning tax-reforms and other matters).

148. *Documenti della Maona di Chio (secc. XIV-XVI)*, ed. A. Rovere (Genoa 1979), no. 13 (1394).

149. Argenti, *op. cit.*, 147; Rovere, *op. cit.*, no. 14 (1394).

150. Argenti, *op. cit.*, 148; Rovere, *op. cit.*, nos. 13 and 14. There is a discrepancy between the combined total of 62 workers given by Fatinati and the separate totals in Rovere's documents (which report more than 31 *tabularii* plus more than 46 *piciarii*).

151. Rovere, *op. cit.*, no. 14.

V

In the Late Byzantine period the traditional strategic perspective was abandoned, logistic needs dwindled, and imperial ownership of woodland and scrubland shrank with the granting of such land to individuals and to the church. But a strictly fiscal interest in its exploitation was never lost.

The Early and Middle Byzantine state was, as already noted, a major owner of land in its own right. There is evidence in the Theodosian Code for the payment of rent to the state for the exploitation of timber and firewood and for woodland-pasture on its domains.¹⁵² Documentation of the exploitation of the Middle Byzantine state's own estates is exiguous. As already suggested much woodland in the 'maritime provinces' may in the Middle period have belonged to the state, as presumably did woodland and scrubland in regions reclaimed from Bulgar and South Slavic control, and in the Taurus and Antitaurus. But there can be no doubt that on these lands the Middle and Late Byzantine state continued the earlier practice of charging, and it probably charged for all the categories of exploitation that have already been identified.¹⁵³ One of our best sources is the *praktikon*, or fiscal record, of an imperial estate in western Anatolia, of the year 1073. This mentions the ἐννόμιον of a named *oros*, 'mountain', the βαλανιστήριον of the same 'mountain', and the *ennomion* of a named δάσος.¹⁵⁴ The same document refers to the estate's *orophylakes* (v.s.) The *valanisterion* 'of the *oros*' is, in context, the seasonal charge for the grazing of the βάλανοι (acorns and other wild nuts) basically by pigs, like the western medieval *glan-*

152. *CTh.v*, 14.31; vii, 7.2.

153. This does not mean that the state charged in all circumstances. Two documents of the year 941 reveal the administration selling deserted lands in the peninsula of Kassandreia (S Khalkidike) which had reverted to the state, some of which were uncultivated, on which free collective rights to 'water, or timber, or firewood, or grazing' for the whole peninsula's population are not to be denied by the new owners: *Athos V. Lavra* I. no.2 (941) ll. 28-30 and no.3 (941) ll. 11-13.

154. *Patmos* II, no.50 (1073) ll. 123.124.126.

daticum or *pannagium*. *Oros* and *orophylax* really mean 'woodland' and 'forest-warden'. The *ennomion* meanwhile is the general non-seasonal charge for the grazing of sheep and goats.¹⁵⁵ These charges for pigs and caprovines were applied everywhere. References to the *ennomion* are very frequent. It was applied in all landscapes, wooded and open, and was effectively a tax.¹⁵⁶ The charge on pig-grazing would have been applied widely too. Besides this Anatolian reference, it occurs in Macedonia both in 995 as βαλάνιστρον¹⁵⁷ and in the Palaeologue period in a Serbian document of ca. 1300 as *vlanastro*.¹⁵⁸

A document of 1300 from central Macedonia reveals other charges, ὀροκόπιον, presumably meaning a charge for cutting wood,¹⁵⁹ and στροβιλαῖα, which must refer to the exploitation of fir- and pine-trees, one of which was called στρόβιλος; probably therefore a charge for tapping resin and making pitch and tar.¹⁶⁰ Logically a similar charge will have been applied wherever people extracted gums and resins from trees and shrubs growing on imperially owned lands, particularly since these products were valued enough to be commercialised over long distances (for which see III and VI).

Certainly over two of these arboreal products or extracts, at least on imperial properties, the state maintained control, namely kermes and mastic, and possibly over oaken tanning and dyeing agents too. An imperial document of 1301 reveals an imperial

155. The *valanisterion* does not refer to the *dasos*, only the *ennomion* does this. The *dasos* (in Modern Greek 'forest') may then refer to scrubland. That *dasos* and related words had kept an ancient connotation of scrubland is indicated by such descriptions as δρὺς χαμαδὸς δασὺς ('stunted oak thicket'): *Le monastère de Notre Dame de Pitié en Macédoine*, ed. L. Petit, *IRAIK* 6 (1900), no. 8 (1152) 42.

156. Harvey 104, n. 95 identified the *ennomion* as 'exactied specifically for the use of common or state land as pasture'.

157. *Athos XIV. Iviron* I, no. 9 (995) l. 51: τὸ βαλάνιστρον καὶ τὰ λοιπὰ ἐννόμια.

158. See Kondov, 'Das Dorf Gradec . . .' (1977), as cited n. 7, 85.

159. *Athos XV. Xénophon*, no. 4 (1300) l. 12; and for the meaning of *orokopion*, *idem* 91.

160. *Xénophon*, no. 4 (1300) ll. 12-13. See the relevant entries in part VI below.

monopoly on the sale of the kermes-parasite (the Byzantine *prinokokkion*), a source of scarlet dyes, which settles mainly on the holly oak (*quercus coccifera*/πρίνος), the ubiquitous arborescent bush of Mediterranean scrubland (see VI).¹⁶¹ The same document grants complete control of an oakwood (δρυμῶν) to a monastery in the S. Peloponnese, with its 'crop', τῆς συνεισφορᾶς ἀπάσης τοῦ βαλανιδίου. The wood and its crop had previously belonged to the state.¹⁶² It is impossible with such a reference to distinguish among the oak-tree's products, and the act presumably did not seek to do so. It should be a question here of both acorns and their cups, and galls, the acorn being pig-fodder (mast) and the cup and galls being tanning and dyeing agents (see VI). Venice maintained and probably inherited from Byzantium a commercial monopoly on these tanning and dyeing agents.¹⁶³ Officials of Andronikos II confiscated a Venetian shipload of these products, and timber, in 1319.¹⁶⁴

Mastic, the highly prized extract of one type of terebinth, was in the early fourteenth century still an imperial productive and commercial monopoly, from which the emperor Andronikos II sought to exclude western middlemen such as the Venetians.¹⁶⁵ There is evidence of its production in Crete and Cyprus, but Andronikos' concern will have been with the mastic of Chios,

161. *JGR* I, Coll.V, nov.23 (1301) 562-7: πρὸς τοῦτοις δὲ ἔξει ἐπ' ἀδείας τὸ μέρος τῆς αὐτῆς . . . ἐκκλησίας ἐξωνεῖσθαι καὶ τὸ πρινοκόκκιον, ὅπερ οἱ τῆς ῥηθείσης μονῆς τοῦ Ζαραφῶνος καὶ οἱ τοῦ δηλωθέντος χωρίου τοῦ Γαγκανέα πάροικοι ἐπισυνάγουσιν ἀπὸ τοῦ διαφέροντος τῇ αὐτῇ ἀγιωτάτῃ ἐκκλησίᾳ· ὅσον μέντοι πρινοκόκκιον ἐπισυνάγουσιν οἱ τοῦτοι πάροικοι τῆς ἐκκλησίας ἀπὸ δημοσιακοῦ τόπου ὀφείλει ἐξωνεῖσθαι τοῦτο ὁ δημόσιος.

162. *Idem* 526.

163. For the Venetian public monopoly in its formerly Byzantine possessions see Thiriet, *La Romanie vénitienne* 325.

164. See Part VI: GALLS.

165. The fourth truce (*treuga*) between Venice and Byzantium, of March 7, 1303, contains the following: 'Item quod abstinere se debeant omnes illi qui de parte ipsius illustris Ducis et communis Veneciarum sunt negociari ut mercationes sal et masticem in tota terra et pertinencijs Imperij nostri': *Diplomatarium veneto-levantinum sive acta et diplomata res venetas, graecas, atque levantis illustrantia a. 1300-1350*, ed. G.Thomas (Venice 1880) 17. For the context see J.Chrysostomides, *art.cit.* n.116,273 onwards.

the most highly prized since Antiquity (see VI), since this island was still under Byzantine control. We do not know how the Byzantine regime administered production, but Genoese arrangements, under which the producers were exempt from taxes and *corvées* in exchange for the obligatory sale to the authorities of all production, probably echo Byzantine arrangements.¹⁶⁶

Finally, hunting, baiting, and snaring, though not yet obvious in the archival record as revenue-earners, were, at a date preceding the earliest such documents for Anatolia or Greece, taxed, seemingly in kind, on the basis of Theodore the Studite's account of the Empress Irene's abolition of taxes (or charges) on these and other activities in 801 AD.¹⁶⁷ Strong similarities between her list of abolitions and her successor Nikephoros I's list of fiscal 'vexations'¹⁶⁸ make it likely that such charges were reinstated. Here was something for the *orophylakes* (wardens of imperially controlled woodland and scrubland) to control. There is at that date moreover no sense of a group of activities, and the land upon which they were practised, being reserved for a courtly and princely class. These activities were clearly, in the mind of Theodore the Studite, above all a set of means whereby ordinary people subsisted.¹⁶⁹ Only much later, at the end of the twelfth century, can one glimpse a different (western?) attitude, one which the historian Niketas Khoniates mocks when he says that imperial woodlands from which shipbuilding timber could have been taken were instead reserved for imperial hunting parties, and that the

166. For administrative continuity on Chios see P. Argenti, *Chios vineta* (Cambridge 1941) clii and cclxxii; Balard, *La Romanie génoise 744-5*; *idem*, 'The Genoese in the Aegean (1204-1566)', *Latins and Greeks in the Eastern Mediterranean after 1204*, edd. B. Arbel-B. Hamilton-D. Jacoby (London 1989) 171 onwards.

167. See W. Treadgold, *The Byzantine Revival 780-842* (Stanford 1988) 117-18 for the political context; N. Oikonomidès, 'De l'impôt de distribution à l'impôt de quotité à propos du premier cadastre byzantin (7^e-9^e siècle)', *ZRVI* 26 (1987) 13 for the fiscal context.

168. See Treadgold, *op. cit.*, 150-2, 164-5 and 169; for Nikephoros I's taxes.

169. For example: ὁ τοξώτης ἢ ὁ ἰξευτής οὐσπερ ἐθήρευσεν ὀλίγους τάχα ὄρνεις, ἐξ ὧν αὐτῷ ἡ ἀναγκαία τροφή, ἀλογοθέτητος διαμένων εὐζωήσκειν: *Theodori Studitae epistulae*, ed. G. Fatouros (Berlin-New York 1992), no. 7. 59-61.

wardens (φύλακες ἑκτομίαι . . .) were wardens καθάπερ ἱερῶν ἄλσεων, εἰπεῖν δὲ καὶ θεοφυτεύτων παραδείσων.¹⁷⁰ The implicit mockery, coming as it does from another member of the élite, suggests that something like the western concept of Chase, let alone Forest Law, was not taking root. And indeed there is no obvious evidence, legal, archival, or anecdotal, that it ever did.¹⁷¹

We learn about many of the charges at the point when the resources were being transferred into the hands of individuals or the church. Unfortunately we learn nothing about the private administration of arboreal resources in Byzantine Anatolia, Byzantine Greece, or the other areas of concern. There is almost nothing corresponding to Byzantine manorial accounts. We merely learn occasionally of the buying and selling of woodland (almost invariably of oaktrees when stipulated),¹⁷² of disputes over the ownership of such woodland,¹⁷³ and, interestingly, that lessors considered woodland as a fixed asset not to be consumed by tenants, δενδροτομία being grounds for terminating an agreement.¹⁷⁴

* * *

170. *Nicetae Choniatae Historia* 540.

171. See for convenience Wickham, *art.cit.* n.19, 481-5, for the development of Forest Law, where it is a question of 'land not so much defined by economic type . . . as by legal restriction' (485), distinguished above all by the arrogation of princely and then aristocratic hunting rights. Wickham points out (486) that the imperial *saltus* of the Late Roman/Early Byzantine period, with their mixture of woodland, uncultivated ground, and some cultivation, were not imperial hunting reservations.

172. Groups of oak-trees (always enumerated, the largest number being 36) occur quite frequently for instance among the purchases of the Lemvotissa Monastery in W Asia Minor: *MM* IV, no.39 (1274) 95; *MM* IV, no.41 (1281) 98-99; *MM* IV, no.52 (1283) 130-1; *MM* IV, no.46 (undated) 104. Oak-trees are often enumerated in imperial grants. See for instance *Patmos* II, no.50 (1073) ll. 303-4, where it is a question of 42 trees altogether.

173. *Patmos* II, no.70 (1271) for instance concerns a dispute between the monastery of St John of Patmos and the bishop of Kos over ownership of an oakwood and olivegrove on Kos.

174. In 1162 the monastery of Lavra was in dispute with *pronoiaríoi* to whom it had leased land on the north side of Lake Langadas in central Macedonia. By an agreement of ca. 1118, which had been broken by the *pronoiaríoi*, the installation of houses and threshing floors, *dendrotomia*, and other abuses, were grounds for

It seems likely that a great deal of uncultivated land, i.e., woodland and scrubland, was deemed to belong to the state at a certain distance from easily settled and cultivated areas. As emperors granted away these lands they granted to the beneficiaries the rights to the charges upon the different forms of exploitation, which thus became rents payable to the aristocracy and the church. Later emperors also implicitly granted the right to dispose of the major products (timber, firewood, pitch, charcoal), which earlier emperors had not, thus encouraging a commercialisation which they could no longer prevent. The same transferral of rights also affected 'crops' like kermes and *valanidia*. A true imperial monopoly such as that of mastic was exceptional. But imperial forests must have continued to exist, supporting groups like the *samdarii* and *pixarii* of fourteenth-century Chios.

It is not yet possible to detect a primacy of application, static or shifting, among the state's instruments of acquisition respecting the exploitation of arboreal resources. Wherever the primacy lay though it is fairly clear that the major arboreal resources were major targets of forms of *militia*, of public *corvée*, of requisition and of enforced sale, in the Byzantine world at all times. The need in that technological era for the resources and products concerned, the inefficiency of the market, and fiscal problems of the kinds experienced by medieval states, made such practices unavoidable. Commutation for some, as indicated by the Chiote evidence, was therefore only part of a strategy of pre-emption. Nevertheless as in the late period commercial relations in *Romania* expanded, and the domination of private estates on the land came about, the Byzantine state's strategic perspective became untenable, and, as its logistic needs dwindled, to some extent unwarranted. A reduced scale of pre-emption could have then co-

rescinding the agreement: *Athos V. Lavra* I, no.64 (1162) ll. 70-4. *Dendrotomia* is the subject of a series of Roman definitions and rulings reproduced in the ninth-to-tenth century *Basilica* and the tenth-century *Synopsis Maior*. See respectively *Basilicorum libri LX*. Series A, vol. VIII, edd. H. Scheltema-D. Holwerda-N. van der Wal (Groningen 1988), LX. 16. 1-14; *JGR* V, IV. 3. 1-7.

existed with a probably growing trade in the products of woodland and scrubland.

There are several ways in which at the interface of the environmental sciences and archaeology the study of the forces of production in the Byzantine world in general will advance. It is to be hoped that in some settings collaboration can shed more light on the history of the exploitation of arboreal resources, while archival studies (Venetian? Ottoman? Genoese?) do the same, where continuities of practice seem likely, for the control and value of certain kinds of exploitation. Meanwhile there can be little doubt about the economic importance of the arboreal sector of the Byzantine rural economy (except on the Anatolian plateau), its importance to the state as a source of revenues in cash and kind, its importance for commodity-production and trade, and thus its value for the rural population as a source of tradeable primary and secondary products.

* * *

VI

Some primary and secondary products of trees and shrubs of Greece, Cyprus, Anatolia, and Syria, known to have been extracted in the Middle Ages

Entries are under the name of the tree or shrub, or under the generic name of a product or extract, typically derived from more than one kind of plant. On the basis of ancient and medieval sources and of modern ethnography, nearly all trees and shrubs, both cultivated and wild, were used for fuel, fodder, and charcoal-making, scrubland and orchards being major sources around the E.Mediterranean. So there is no systematic mentioning of this fact under entries. Also excluded are certain spontaneously occurring trees valued above all for woodworking (ashe, beech, box, cypress, hornbeam, and others). It should be borne in mind too that other indigenous trees and shrubs, not documented here, must have been exploited to obtain their special products in the

Byzantine era, as they were in Antiquity or in the post-Byzantine era (senna, myrtle, etc.).¹⁷⁵ All unattributed statements are derived from the historical and philological data contained in *The Oxford English Dictionary* I-XX (Oxford U.P. 1989).

Bark/φλοιός

Bark, ringed and stripped in season, was a major source of dyeing materials. The bark of the oak, walnut, linden, and mulberry, among others, were valued in the medieval eastern Mediterranean world.¹⁷⁶ To ring another person's trees (ζωννύειν τό περιελείν τὸν φλοιόν) was equated with felling, the penalty for which was restitution of the value of the trees themselves.¹⁷⁷

Bay-tree/δάφνη

Sfikas(1), no.27 (*laurus nobilis*), a tree or shrub also known as the sweet bay. The leaves or berries, or perhaps the oil expressed from them, were, according to one source, imported from the Byzantine world into the Islamic world.¹⁷⁸ It must have been exported from Crete.¹⁷⁹ The aromatic oil and the decoction of the leaves had many perceived uses.¹⁸⁰ Pierre Belon noted in the mid-sixteenth century that from the bay-tree the monks of Mount Athos extracted an oil in which they had a considerable trade.¹⁸¹

175. See *Polunin* 193-203 for an impression of the range of traditional tradeable arboreal products coming from southern or Mediterranean Europe.

176. See Cvetkova, *Vie économique de villes et ports balkaniques* 90 (Table 6) for linden-bark. See below under GALLNUT and OAK-TREE for some further references. For the numerous other barks of Mediterranean trees and shrubs traditionally exploited for tanning and dyeing purposes see for convenience *Polunin, loc.cit.*

177. For example, *Basilica* VIII A, LX. 16. 5; *JGR* V, IV. 3. 4. and IV. 3. 7 (Synopsis Maior).

178. A.Miquel, *La géographie humaine du monde musulman jusqu'au milieu du 11^e siècle* III. *Le milieu naturel* (Paris 1980) 425.

179. Tsougarakis, *Byzantine Crete from the 5th century to the Venetian conquest* 287.
180. See *Ducange, sub* δαύνη, and δαφνόκοκκα, and *Kriaras, sub* δαφνέλαιον and related entries, for the substances. See *Geoponica* 2.7.3 and 2.30.1, for some traditional uses; and *Polunin* 197 for more recent times.

181. *Belon*(2) 98.

Camel's thorn/ἀσπάλαθος

Sfikas(2), no.74 (*calycotome infesta* and *calycotome villosa*), shrubs still called in Greece *aspalathos*.¹⁸² The price of *aspalathos* was controlled by Diocletian (*Aezani* 34.70). Crawford and Reynolds argue that this was 'Syrian' camel's thorn,¹⁸³ but the shrub has a very wide distribution. A fragrant oil was extracted. The root of the *aspalathos* was one of many ingredients used in flavouring wines.¹⁸⁴ The Cretan *aspalanthos* recorded by *Ducange* is presumably the same plant.

Carob-tree/κερατέα, κεράτια, κερατία

Sfikas(2), no.71 (*ceratonia siliqua*), the tree, both wild and cultivated.¹⁸⁵ Ioannes Eugenikos refers in the mid-fifteenth century to carobs (the bean and bean-pod) as part of the diet of animals browsing in the woods on his estate at Petrina in Laconia.¹⁸⁶ The nutritional value of the carob-bean is high.¹⁸⁷ The bark and leaves were also traditionally exploited for tanning.¹⁸⁸

Castor-tree/καστόριον¹⁸⁹

Polunin 113 (*ricinus communis*).

Aezani 34.76-77 deals with 'Pontic castor oil' (*castorigi pontici*) and 'Dalmatian castor oil' (*castorii delmatici*), which would have been derived from the castor-tree. See Crawford and Reynold's commentary on *Aezani* for references to medical uses.¹⁹⁰

182. *Sfikas*(2) 209.

182. *Aezani* 207-8 (Commentary). Syrian references can be found in E.Honigmann, 'Syria', *Real-Encyclopädie der classischen Alterumswissenschaft* 2.Reihe, 4. Band (hereafter, *Honigmann*) col. 1560-1.

184. *Geoponica* 7.20.7.

185. See *Geoponica* 10.72 for the planting of the carob-tree.

186. Κώμης έκφρασις, Lampros, *Παλαιοιολόγια και Πελοποννησιακά*, I, 52, ll. 6-8.

187. *Polunin* 195.

188. *Idem*, loc.cit.

189. *Kriaras*, sub καστόριον (2).

190. *Aezani* 209 (Commentary).

Cedar/κέδρος

A conifer, *pinus cedrus* or *abies cedrus*. The E.Mediterranean variant, *cedrus libani*, while never associated with Greece, still occurs naturally in stands spread along the southern coast of Turkey,¹⁹¹ and in Cyprus,¹⁹² and formerly in Syria, within our area of concern.¹⁹³ The cedar was in great demand in Antiquity and in the Byzantine era for its timber and for its extracts. It was a prime source of pitch, resin, and resinous oils. They formed components of medicines, antiseptics, embalming fluids, and wood-preservers.¹⁹⁴ Most of these uses, and other uses that were doubtless traditional, are recorded in, or can be inferred from, Byzantine sources. The *Geoponica* records liquid cedar pitch as a component of skin-treatments;¹⁹⁵ it records *kedrea* as an insect-killer, insect-repellant, and as a component of skin-treatments,¹⁹⁶ and records the preservation of wine with 'the fruit of the cedar'.¹⁹⁷ Indeed a type of wine was known as *kedraia*.¹⁹⁸ *Diocletian* 36.35-36 regulates the price of *kedrion*. *Aezani* 33.16 regulates the price of *cedria*.¹⁹⁹ Cedar-wood is recorded as exported from the Gulf of Issos in the Early Middle Ages.²⁰⁰ Slightly later the Book of the Eparch refers to the sale of *kedraia* or *kedria* in Constantinople immediately after the sale of hard and liquid pitch.²⁰¹ *Kedrea* was a major requirement of a Byzantine naval and military expedition.²⁰² Many references

191. *Meiggs* 358,394,411,414.

192. *Idem* 136.

193. *Idem* 411 and 414, also n.10.

194. E.Semple, *The geography of the Mediterranean Region. Its Relation to Ancient History* (London 1932) 282. See also *Lauffer* 283 for references, and for a longer-term perspective *Meiggs* chap. 3.

195. *Geoponica* 16.18.1.

196. *Geoponica* 5.9.9,13.7.2,13.10.2,13.14.6,16.22.1,18.15.5,18.16.2.

197. *Geoponica* 12.9: κέδρου τὸν καρπὸν.

198. *Ducange, Omissa et addenda. Omissa alia quaedam, s.v.*

199. Translated by Crawford and Reynolds as 'cedar resin': *Aezani* 201 (Commentary).

200. H.Hellenkemper-F.Hild, *Neue Forschungen in Kilikien* (Vienna 1986) 104, n.31.

201. *Eparch* 31.1.

202. *De Cerimoniis*, I, 673.

to *kedrion*, *kedrea*, or *kedria*, are probably to the resin and oils, which had so many uses. There are good reasons for believing that they were extracted from the cedar and the juniper (q.v.), or rather juniper-group, and that both were known by the same names.²⁰³

'Chaste'-tree/ἄγνος

Sfikas(2), no.182 (*vitex agnus castus*), a tree or shrub with aromatic properties, parts of which were ascribed medical properties. The leaves were a traditional fumigant. According to one source it was imported from the Byzantine world into the Islamic world.²⁰⁴ For the name see *Ducange*, Addenda in glossario, s.v.

Chestnut (sweet)/κάστανος, καστανέα²⁰⁵

Sfikas(2), no.146 (*castanea sativa*), a woodland tree. A document of the tenth century refers to a 'dearth of acorns . . . or chestnuts' in the context of pig-grazing in the Khalkidike. That the sweet chestnut was a valued tree is indicated by the *Geoponica*'s references to planting it.²⁰⁶

Christ's thorn/παλιούρος

Sfikas(2), no.150 (*paliurus aculeatus, p.spina christi*), Modern Greek παλιούρι.²⁰⁷ There may have been a demotic variant παλιρέα.²⁰⁸ A common Mediterranean scrubland-bush,²⁰⁹ its seeds were crushed to make a linctus.²¹⁰

Euphorbia/εὐφόρβιον

One or more of the group of shrubs of this name was the source

203. *Meiggs* 415-416.

204. Miquel, *La géographie humaine du monde musulman jusqu'au milieu du 11^e siècle*, III 425.

205. *Kastanos* is the common Byzantine word for both the tree and the nut. See *Athos XVI. Iviron* II, no.49 (1100) l. 15, for *kastanea*.

206. *Geoponica* 3.3.5, 3.15.7, 10.3.7, 10.63.1-4.

207. *Sfikas*(2) 211.

208. *Ducange*, s.v.

209. *Polunin* 133-4.

210. Theophrastus, *Enquiry into Plants* 3.18.3; *Ducange*, s.v.

of a resinous gum²¹¹ which could be powdered, with traditional medical uses.²¹² *Diocletian* 36.103 regulated the price of *euphorbion* (presumably the extract).

Fir-tree/ἐλάτη, στρόβιλος

Sfikas(2), nos.9-12 (the *abies* and *picea* groups of conifers). Modern Greek names for both groups are derived from ancient Greek ἐλάτη. An enduring distinction was made between firs and pine-trees. But firs may also have sometimes been called, along with pines, στρόβιλοι.²¹³ One of them was the source of an extract used to flavour wine.²¹⁴ The *Geoponica* seems to refer to the fir-tree as *strobilos* in a list of evergreen trees, if one can assume that πίτυς there refers to the pine.²¹⁵ For the range of exploitations, Byzantine and in general pre-industrial, see RESIN, στροβιλαίαι and PITCH in this section; for timber, the discussion in II and III.

Galbane/χαλβάνιν

The resinous gum of one or more of the shrubs of the Giant Fennel group (*Ferula*),²¹⁶ used as a fumigator and in traditional medical preparations, also in textile-dyeing.²¹⁷ Galbane was produced in S.E. Anatolia²¹⁸ and in Syria.²¹⁹ See *Ducange*, s.v., for the Byzantine name.

Galls/κηκίδια, Βαλανίδια

The gall ('gallnut'), the much sought tannine-rich growth found on the leaves, stems, and bark of oak-trees; prolifically on some

211. *Euphorbia resinifera*, the 'euphorbium gum plant'? See *Van Wijk* I, 527; or *e.pithyusa* (*Idem* I, 526)?

212. See *Lauffer* 288 for further references.

213. *Liddell-Scott*.

214. *Sophocles*: ἐλάτινος.

215. *Geoponica* 11.1.

216. Probably *f.galbaniflua* (usually associated with Persia) and *f.tingitana* (Syria and N Africa): *Van Wijk* I, 540 and 541.

217. See *West* 171 for the use of *galbanum* for dyeing textiles.

218. *T.I.B.* 5. *Kilikien und Isaurien* 111.

219. *West* 166 (Table II).

types (e.g., on *quercus macrolepis* and *quercus infectoria* or *lusitanica*), used as a dyeing and tanning agent, in ink-making,²²⁰ and in traditional medical preparations.²²¹ The Cairo *Genizeh* records their exportation from N.Syria to Egypt.²²² In the Late Byzantine period they were being exported from Macedonia,²²³ Euboea,²²⁴ and Corfu,²²⁵ and their exploitation was controlled on imperial properties in the Peloponnese.²²⁶ They were one of the Ottoman exports of the Peloponnese,²²⁷ Macedonia,²²⁸ and Thrace,²²⁹ in other words from any region that had extensive oak-woods. The 'gall-oak' (*q.infectoria*) is still called in rural Greece κικιδοβελανιδιά.²³⁰ The terebinth-family, which flourished in N.Syria as elsewhere, is also a traditional source of galls.²³¹

Holly oak and holmoak/πρίνος, πρινάριον

The holly oak (*quercus coccifera*) is *Sfikas*(2), no.145. The holmoak (*quercus ilex*) is *Sfikas*(2), no.144. *Prinos* and *prinarian* were probably the Byzantine names for both, and presumably also for the large holly oak of Anatolia and Syria (*q.calliprinus*). These are the Mediterranean evergreen oaks.²³² Depending upon

220. *Laographika* I, 454, where also Byzantine references to ink being made from the barks of the mulberry-tree and walnut-tree.

221. *Kriaras*, sub κικιδίου.

222. *Goitein* 213. The galls of Syria are also mentioned by Vegetius (*West*, 165, Table II).

223. Mertzios, *Μνημεία μακεδονικής ιστορίας* 20 (from the *Commemoriali*: a communication from the Doge to Venetian ambassadors negotiating with Andronikos II, 27-9-1319). Mertzios presumably excerpted R.Predelli-P.Bosmin, *I libri commemoriali della repubblica di Venezia regesti (1293-1787)*, I-VIII (Venice 1876-1914).

224. Thiriet, *La Romanie vénitienne* 338.

225. *Idem* 349.

226. *JGR* I, Coll. V, nov. 23 (1301) 526.

227. V.Kremmydas, *Το εμπόριο της Πελοποννήσου στο 18ο αιώνα (1715-1792)* (Athens 1972) 195.

228. N.Sovoronos, *Le commerce de Salonique au XVIII^e siècle* (Paris 1956) 280.

229. A.Boué, *La Turquie d'Europe* III (Paris 1840) 157.

230. *Sfikas*(2), no.141.

231. *Polunin* 202; *Meiggs* 469.

232. *Liddell-Scott, Ducange*, ss. vv. *Rackham*(2) 327, n.82 points out that the Ancient Greek for *q. ilex* was ἄρια. I can find no trace of this in Byzantine archives or in the Byzantine lexica (*Ducange*, *Kriaras*, *Sophocles*). This is not conclusive of course,

the intensity of grazing they will progress from bush to tree, the holmoak most easily.²³³ These bushes or trees were the source of kermes (see *πρινοκόκκιον*). The bark of *q. ilex* was traditionally used for tanning and its wood was particularly valued for charcoal-making.²³⁴ The roots of the ubiquitous holly oak were traditionally used for tanning (and were not the only tree-roots so used, the walnut's being another).²³⁵ The acorns of both oaks also provided seasonal fodder, though not on the scale of some deciduous oaks (see MAST and OAKTREE).

Jujube/ζίζυφος

Polunin, 134 (*ziziphus jujuba* and *z. lotus*). Both a spontaneously occurring and planted tree of southern and eastern Mediterranean countries, valued for its fruit.²³⁶ Perhaps *eleagnus angustifolius* (*Sfikas*(2), no.85), the Modern Greek τζίτζιφιά, whose fruit is edible and well regarded, should also be associated with the ancient and medieval *zizyphos*. *Diocletian* 6.56 regulates the price.²³⁷ The products of the jujube were exported from N.Syria to Egypt in the Middle Ages.²³⁸

Juniper/ἄρκευθος, κέδρος

Sfikas(2), nos.14-20: the *juniperus*-group of coniferous trees and shrubs. At least five types of juniper are known in Modern Greek as *kedros*, each with a different prefix.²³⁹ The general term in Modern Greek is *kedros*,²⁴⁰ as probably the Ancient Greek.²⁴¹

but when the *Geoponica* refers in a section on trees (*op.cit.*, 11.14) to planting the *pinos* to attract the *coccum ilicis* (*prinokokkion*), which favours all these evergreen oaks, would the text not have distinguished the attractive holmoak from its two prickly cousins if it still had a different name?

233. *Rackham*(2) 299; *Rackham*(1) 189.

234. *Sfikas*(2), no.144.

235. Observed by Sibthorp, a botanist travelling in Greece in the late eighteenth century: *Memoirs relating to European and Asiatic Turkey*, ed. R. Walpole (London 1817) 237.

236. See *Geoponica* 10.43.

237. See *Lauffer* 231 for further references.

238. *Goitein* 213. Pliny mentions the fruit-bearing *zizyphus* of Syria (*Honigsmann* col.1560).

239. *Sfikas*(2) 209.

240. *Μέγα αγγλο-ελληνικόν λεξικόν* I-IV (Athens, undated), s.v.

241. See *Meiggs*, Appendix 3.1; also *Rackham*(2) 331 and 332.

The ancient *arkeuthos*, which perhaps was applied to one type, has survived though.²⁴² Besides being used for joinery the wood was sought for charcoal-making and was burnt for its aroma, not merely as fuel. The berry was used widely and its oil was used in medical preparations.²⁴³ The seeds were also burnt for their aroma. The question arises whether some substances called in Byzantine sources *kedraia*, *kedrea*, and *kedria*, could have been derived from different kinds of juniper. The juniper is ubiquitous,²⁴⁴ and some varieties are known for their resin.²⁴⁵ See CEDAR and RESIN.

Mast/βαλανίδιον,²⁴⁶ βαλάνιον,²⁴⁷ βάλανος²⁴⁸

These terms refer to the crop of acorns, *valanoi*,²⁴⁹ shed by all kinds of oak-trees, in Byzantine Greek βαλανίδες,²⁵⁰ δένδρα βελανιδέα,²⁵¹ βάλανοι,²⁵² δρυς,²⁵³ δρύινα δένδρα,²⁵⁴ and other names (for which see HOLLY OAK, HOLMOAK, OAKTREE). *Valanidion* probably also refers to GALLS (q.v.) And the terms for mast were probably used loosely to refer to beechnuts and chestnuts (the trees are frequently found together at higher altitudes). The Modern Greek βαλανίδι retains this sense.²⁵⁵

242. *Geoponica* 11.1.1 distinguishes between *kedros* and *arkeuthos*. The latter name apparently survives in Crete (*Kriaras*, s.v.).

243. It is still traditionally recommended: *Sfikas*(1), no.26. *J.oxycydrus* is the normal source (*Meiggs* 410).

244. *Polunin* 26.

245. *J.oxycydrus*, for instance, which flourishes around the E Mediterranean (*Van Wijk* 1,708).

246. *JGR* I, Coll. V, nov. 23 (1301) 526.

247. *Kriaras*, s.v.

248. *JGR* V, II.2.1 (Synopsis Maior).

249. *Athos XIV. Iviron* I, no.9 (995) l. 49. See also *Kriaras*, s.v.

250. *Les archives de Saint-Jean-Prodrôme*, no.35 (1339-1342) l. 50.

251. *Idem*, no.39 (1345) ll. 74-5.

252. *Laographika* I, 291, no.4.

253. The ancient word, favoured in official documents. See *Kriaras*, s.v., for literary references.

254. *Patmos* II, no.69 (1263) l. 27.

255. *Kriaras*, sub δρυοβάλανος: βαλανίδι.

Mastic/μαστίχη

The resinous gum exuded from the bark of the MASTICH-TREE (LENTISK), much sought after throughout the Ancient, Byzantine, and Islamic worlds.²⁵⁶ Medieval references to the production and commercialisation of mastic mostly concern Chios, where there was a Byzantine imperial monopoly,²⁵⁷ but there is evidence also for Cyprus and Crete.²⁵⁸

Mastich-tree, Lentisk/σχίνος

Sfikas(2), no.104, a sub-type of *pistacia lentiscus* (the terebinth). The mastich-tree was the source of the resinous gum MASTIC (q.v.); of the resinous extract τερεβινθίνη, natural turpentine, also extracted from other varieties of TEREBINTH (q.v.); and the source of a type of PITCH (q.v.);²⁵⁹ while an oil was extracted from the berry,²⁶⁰ and the wood was traded too, perhaps for burning as an aromatic substance. *Diocletian* 36.63 regulates the price of mastic of Chios (μαστύχης Χείας), as well as of *terebinthinae Chiaie* (op.cit.,36.127). *Aezani* 34.17-18 regulates the price of *mastichae albae Chiaie* and *mastichae nigrae*. It also regulates the price of *olei mastichini* (op.cit.,34.71) and of *xylomastiches* (op.cit.,34.79). The Nea Mone had mastich-trees (*skhinoi*) at its metokhion of Khalazousia on Chios,²⁶¹ which are distinguished from ὀπωροφόρα δένδρα.

Oak-tree/βάλανος, βαλανίς, δρύς, ἡμερίς²⁶²

Sfikas(2), nos.133-145. βελανιδιά, with prefixes to distinguish the different varieties, is the commonest Modern Greek name for

256. See *Lauffer* 285 and 286 for references to Antiquity; Balard, *La Romanie génoise* 742 for Arab geographers' references to the mastic of Byzantine Chios.

257. For Chios see now Balard, *op.cit.*, 742-6.

258. See Malamut, *Les îles de l'empire byzantin* II, 388-9.

259. *Geoponica* 6.7.1.

260. See below: TEPEBINΘINH.

261. *MM* V, no.7 (1259) 12.

262. Eustathios of Thessalonica refers to one type of oak-tree noted for its crop as ἡμερίς, whence several modern Greek names (*Laographika* II, 290-1). See in this section under MAST for other names. Βελανιδιά, with prefixes to distinguish the different varieties, is the commonest Modern Greek name for the deciduous oak-tree, though δρύς and βαλάνι are known: *Sfikas*(2) 207 and *Rackham*(2), Appendix I, 349).

the deciduous oak-tree (*Ibidem*, 207). Oak-trees, of which numerous varieties flourish in E.Mediterranean landscapes, besides being a source of timber, firewood and charcoal, were the source of several other valued products: the acorn (see MAST), kermes (see *πρινοκόκκιον*), and GALLS (q.v.).²⁶³ The *Geoponica* lists some agricultural uses of products and by-products (ash and chopped acorns for fertiliser; use was made of the leaves, mainly for fodder; and other exploitations were recommended).²⁶⁴

Olive (wild)/φυλλία

This is Eustathios of Thessalonica's *phylia*, the Modern Greek φύλικας, αγριλιός, and derivatives.²⁶⁵ Besides the normal uses (for fodder, firewood, and charcoal), the fruit of the wild olive was until recently a source of soap-oil.²⁶⁶

Pine-tree/πεύκη, πίτυς, στρόβιλος

Sfikas(2), nos.1-8 (the *pinus*-group of conifers). The distinction has been inherited in Modern Greek from Antiquity between the pines, most of whose names are derived from Ancient Greek πεύκη,²⁶⁷ and the firs, whose names are derived from Ancient Greek ελάτη (for which see FIR-TREE).²⁶⁸ One pine however, *pinus heldreichii* found throughout N.Greece, is in Modern Greek ρόβολο,²⁶⁹ clearly derived from Ancient Greek στρόβιλος,

263. See for instance *Sfikas*(2), no.141; M.Lombard, *Études d'économie médiévale* III. *Les textiles dans le monde musulman du VIII^e au XII^e siècle* (Paris 1978), hereafter *Lombard*, 144, for the value of the acorn and its cup. The acorn-cup was being exported to the west from central Greece and the Peloponnese in the eighteenth century (Kremmydas, *Το εμπόριο της Πελοποννήσου* 195); from the islands of Lesbos and Agios Eustratios (Mertzios, *Μνημεία μακεδονικής ιστορίας* 262,304,307); and doubtless from other convenient locations too.

264. *Geoponica* 5.24.1,10.76.5. Oak-leaves were traded by the load in the late medieval Balkan urban market: Cvetkova, *Vie économique de villes et ports balkaniques* 89 (Table 5).

265. *Laographika* II, 293. There are of course other local names of Slavonic and Albanian origin.

266. Forbes, 'Farming and foraging in prehistoric Greece . . .', *art.cit.* n.13, 131.

267. *Liddell-Scott*, *Sfikas*(2) 211.

268. *Liddell-Scott*, *Sfikas*(2) 212-13.

269. *Sfikas*(2), no.6 and 211.

which was apparently applied to both pines and firs.²⁷⁰ However there is no reason to believe that this name was applied in a technical way to only one type of pine in the past (see the entry for στροβιλαίαι). The Ancient Greek πίτυς, applied particularly to *pinus pinea*, may have yielded ground to it.²⁷¹ For the range of exploitations, Byzantine and generally pre-industrial, see the entries for στροβιλαίαι, PITCH, and RESIN. Some types of pine were an important source of timber.

Pitch/πίσσα

Apart from the naturally occurring asphalt or bitumen, pitch is the tarry residue left after heating the resins of cedars, firs, junipers, pines, and terebinths,²⁷² or after boiling,²⁷³ or burning, the wood of these resiniferous trees.²⁷⁴ It could be mixed with water and resin, and had an enormous range of applications.²⁷⁵ *Diocletian* 36.26-27 (*Aezani* 33.7-8) regulates the price of *colofoniae*, sometimes known as 'Greek pitch', but defined as a resin at *Aezani* 33.10. The Book of the Eparch stipulates who can sell dry and liquid pitch.²⁷⁶ For the state's continual interest in the supply of pitch see III and IV.

πρινοκόκκιον

This is the *cocum ilicis*, the small insect which lives on the stems of the HOLLY OAK and HOLMOAK, both trees being probably known to the medieval Greeks as *prinos* or *prinarion*. The insect is the source of red dyes, traditionally much sought after, whence πρινοκοκκάτος (of red-dyed silks etc.).²⁷⁷ It merits an entry in the *Geoponica*.²⁷⁸ The control of the collection and sale of

270. Liddell-Scott.

271. Liddell-Scott.

272. Meigs, Appendix 7.

273. See for instance F. Maunsell, 'The Rhodope Balkans', *The Geographical Journal* 28 (1906/2) 17. Maunsell travelled in about 1901.

274. Meigs, *loc. cit.*

275. *Idem.*

276. *Eparch* 13.1.

277. *Koukoulès* II/B 37.

278. *Geoponica* 11.14.

prinokokkia is partly the subject of a Late Byzantine imperial charter.²⁷⁹ The *coccum ilicis* (*c. rubens*) is the *qirmiz* (whence *kermes*, crimson, etc.) of the Arabic world, the *vermilion*, *coccum*, or sometimes *granum* of medieval Latin, and the Ancient Greek κόκκος.²⁸⁰ This dye is recorded as a late medieval export from Corinth and Patras,²⁸¹ and late medieval product of Cyprus.²⁸² The Venetians were shipping the dye in Byzantine Greek waters in the late thirteenth century, having presumably collected it in Greece or Anatolia including the Pontus.²⁸³ This particular Greek 'harvest' was well known to the sixteenth-century traveller Pierre Belon,²⁸⁴ and was still exported from central Greece,²⁸⁵ Macedonia, including Serres,²⁸⁶ the Peloponnese,²⁸⁷ Dyrrakhion,²⁸⁸ and doubtless many other areas, in the seventeenth and eighteenth centuries.

Resin/ρητίνη

An oily exudation of trees of the FIR, PINE and JUNIPER groups, which has also traditionally been tapped; extracted too from the CEDAR and the TEREBINTH. *Diocletian* 36.28-29 regulates the price of resin (ρητίνη); at 36.129 *pityenis*, presumably the resin of the *pitys* (*pinus pinea*); at 36.130 *colofoniae*, the

279. *JGR* I Coll. V, nov. 23 (1301) 526-7.

280. See *Ducange sub* πρινοκόκη, πρινοκόκκα, πρινοκούκιν et al.; J. Niermeyer, *Mediae latinitatis lexicon minus* (Leiden 1976), ss. vv.; *Lombard* 118-19 and 122-3; see P. Walter, 'Textiles', *English medieval industries*, edd. J. Blair-N. Ramsay (London 1991) 334, for W Europe's consumption of such dyes.

281. Zakythinos, *Le despotat grec de Morée* II, 247.

282. J. Richard, 'Une économie coloniale? Chypre et ses ressources agricoles au Moyen-Age', *BF* 5 (1977) 340.

283. See G. Morgan, 'The Venetian Claims Commission of 1278', *BZ* 69 (1976) 436 for the Aegean. For the Pontus see Bryer-Winfield, *Byzantine monuments and topography of the Pontos*, I, 127.

284. *Belon* (1) 126.

285. *Rackham* (2) 332-3. The abundant yield was noted in Boeotia in 1470 by Angiolello: Mertzios, *Μνημεία μακεδονικής ιστορίας* 199.

286. Svoronos, *Le commerce de Salonique au XVIII^e siècle* 280. For Serres see Mertzios, *op.cit.*, 276.

287. P. Topping, 'The post-classical documents', *The Minnesota Messenia Expedition* II (Minnesota 1972) 76; Kremmydas, *Το εμπόριο της Πελοποννήσου* 194.

288. Mertzios, *op.cit.*, 268.

resinae Colofoniae sive Frixae of *Aezani* 33.10, presumably the resin and/or pitch of conifers from parts of W.Anatolia.²⁸⁹ *Aezani* 33.10 also regulates *resinae terebinthinae*, which must be distinct from the mastic-resin of one type of *pistacia lentiscus* also regulated by the Price Edict (see MASTIC). *Aezani* 33.16 also regulates *cedriae Italicum*, cedar-resin by the Italian pound (the editors' interpretation). The incomplete entries at *Diocletian* 36.35-36, beginning κεδρίου, may refer to separated cedar-oil or pitch,²⁹⁰ or to juniper extracts.²⁹¹ Pine-resin is recorded as an export of the Peloponnese in the late Middle Ages.²⁹²

στροβιλαίαι

Athos XV. Xénophon, no.4 (1300 AD), 12-13. The Xenophontos Monastery was granted ownership and tax-free exploitation of a large tract of woodland by the state on the peninsula of Longos (which means 'woodland'; renamed Sithonia), S.Khalkidike, with its incomes, ὀροκόπιον (for the cutting of wood), ἐννόμιον (for the grazing of flocks), σὺν ταῖς ἐκεῖσε στροβιλαίαις. This term is clearly a derivative of στρόβιλος, PINE or FIR (q.v.). The conifer which flourishes in this area of S.Khalkidike is *pinus halepensis*, still being exploited early this century for resin, pitch, and firewood,²⁹³ but not valued as a source of timber. Other varieties of pine have served for that. The pine-nut or pine-kernel derived from the cone (στρόβιλος, στροβίλον, στροβίλιον²⁹⁴) of *pinus pinea* was of course valued and traded.²⁹⁵ In this context *strobilaiai* are probably a range of exploitations of pine- and fir-trees being labelled with a general description, and by extension the fiscal revenues accruing from them. Given the mention of *orokopion*, *strobilaiai* may refer mainly to resin and

289. Colophon was an ancient city of Ionia: see *The Princeton Encyclopaedia of Classical Sites* (Princeton 1976) 233. *Frixae* is reasonably identifiable with Phrygia. 290. *Lauffer* 283.

291. See *Meiggs*, Appendix 3.1.

292. Zakythinos, *Le despotat grec de Morée* II, 247.

293. Turrill, *The Plant-life of the Balkan Peninsula*, 201.

294. See *Ducange* and *Sophocles*, ss.vv.

295. *Diocletian* 6.54: nuclei pinei purgati/στροβίλων καθάρων. See *Lauffer* 230 for further ancient references.

pitch. Licences or rents for their extraction are documented in Antiquity. Their Byzantine successors were here being granted away by the emperor.

Styrax, storax/στύραξ, στόραξ(?)

Sfikas(2), no.172 (*styrax officinalis*), a small tree or shrub, called in Modern Greek (α)στύρακας, στόραξ, στουράκι, and derivatives.²⁹⁶ From it the fragrant resinous gum of the same name was extracted; used in perfumes, fumigation, medical preparations, wine-flavours etc.²⁹⁷ *Diocletian* 36.57-58 deals with *storax* of Cilicia and Antioch (i.e., Syria), *Aezani* 34.45 deals with *olei styracini*. The storax of Anatolia is further documented in both Antiquity and the Middle Ages.²⁹⁸ The storax of Syria is certainly recorded in Antiquity.²⁹⁹

Sumach/ρόυς, ρούσιον

Sfikas(2), nos. 105-106 (*rhus coriaria* and *rhus cotinus/coccygria*), a tree-like shrub. *Rh.coriaria* is the Modern Greek ρούδι,³⁰⁰ or σουμάκι,³⁰¹ *rh.cotinus* being κότινος.³⁰² The leaves and bark were ground into powders for dyeing fabrics and hides black, and were also used in traditional medical preparations.³⁰³ The wood itself was the source of a yellow dye, and the berry was used traditionally in cooking.³⁰⁴ According to the Cairo *Genizeh* archive sumach-extracts were exported from northern Syria to Egypt.³⁰⁵ The *rhus* of Syria is mentioned in Roman and Late Roman sources, and the Arabs seem to have named a mountain

296. See D.Demetrakos, *Μέγα λεξικόν της ελληνικής γλώσσης* (Athens 1936-1951), ss. vv.

297. *Idem*, sub στυρακάτον.

298. See *Lauffer* 285 and *T.I.B.* 5. *Kilikien und Isaurien* 111.

299. See *West* 165 (Table II).

300. *Rackham*(2) 349 (Appendix I).

301. *Sfikas*(2) 213.

302. *Sfikas*(2) 206; *Rackham*(2) 348 (Appendix I).

303. *Lombard* 144. There was an extract of *rous* used for medical purposes, but unspecified, according to the *Geoponica*, 16.8.2.

304. The botanist Sibthorp noted both in Macedonia. See Walpole (ed.), *Memoirs relating to European and Asiatic Turkey* 238.

305. *Goitein* 213.

there after it.³⁰⁶ The extracts were also produced in Cyprus in the Middle Ages.³⁰⁷ The archives of Mount Athos mention several placenames containing the substantive *rousion*, which should indicate the presence of one or other of the shrubs in southern (Mediterranean-to-Transitional) Macedonia.³⁰⁸ Their exploitation was recorded by the professional botanist Dr John Sibthorp, who toured S.Macedonia in 1787.³⁰⁹ 'Ρούσιος was an adjective indicating a range of dyes and colours.³¹⁰ The substantive *rousion* however is not, to my knowledge, to be found in dictionaries.

Terebinth, Turpentine-tree, Lentisk/τερέβινθος, τέρμινθος
Sfikas(2), nos.101-104: a group of trees of the *pistacia* family, the Modern Greek τερέβινθος.³¹¹ To Sfikas's list can be added the *pistacia atlantica* of Anatolia (*Polunin* 120). One of the group, *p.lentiscus*, has a sub-species the MASTICH-TREE (q.v.). *P.terebinthus* was and is widespread in Syria, Cyprus, and Greece.³¹² *Diocletian* 36.115 probably regulates the price of the wood of the terebinth. The tree was also traditionally recommended as grafting stock.³¹³ The terebinth was one of the most commercially useful of the spontaneously occurring trees and shrubs of the E.Mediterranean. For its many primary and secondary products see the entry for τερεβινθίνη.

306. See *West* 165 (Table II) for Roman and Late Roman references. See *Honigmann* col. 1554 and 1560 for the mountain.

307. Richard, *art.cit.* n.282,340.

308. For instance *Athos XIV. Iviron* I, no.10 (996) l. 58 — Ρούσια Περγίνα; *Iviron* I, no.29 (1047) l. 56 — Ρούσια Κρηνά; *Athos XIII. Docheiariou*, no.29 (1355) l. 6 — Ρούσιον.

309. See n.304 for Sibthorp's observation. For the date of his expedition (not mentioned in Walpole's edition) see the *Dictionary of National Biography*.

310. *Ducange*, sub ρουσαίος, ρούσιος et al. Koukoulès, mistakenly I believe, derives the dye *rousios* from ροιά (mulberry): *Koukoulès* II/B 37.

311. Lefort finds the name σμαρδέλι in use in S. Macedonia (*Athos XIV. Iviron* I, 168), which therefore explains the σμάρδαλος of *Iviron* I, no.10 (996) l. 58, and the σμαρδέλος of *Athos XVI. Iviron* II, no.50 (1101) ll. 21 and 22. The terebinth was certainly exploited in Macedonia: see under TEPEBINΘINH in this section.

312. *Meiggs* 469; M.Rowton, 'The woodlands of ancient western Asia', *Journal of Near Eastern Studies* 26 (1967) 273, for Syria.

313. *Geoponica* 10.24,10.65.2,10.76.1-4.

τερεβινθίνη

Extracts of different kinds of TEREBINTH (q.v.) including probably the MASTICH-TREE of Chios (q.v.), principally a natural turpentine. *Diocletian* 36.127-128 regulates *terebinthinae Chiaie* (therefore probably of the Chian mastich-tree) and *terebinthinae secundae*, probably the extracts of the other varieties of terebinth. *Aezani* 33.7 deals with *resinae terebinthinae*. RESIN and PITCH were still being extracted from the wild terebinth of Greece in recent times.³¹⁴ They had many uses for the preservation of timber and woodwork of all kinds, and for the preparation of volatile oils, and in the composition of skin-treatments. To these could be added the use of this particular resin as a preservative of wine.³¹⁵ Oils were extracted from the berries of some types of wild terebinth, and from the nut produced by another uncultivated variety, *p.palaestina*, some or all of which were called σχινέλαιον.³¹⁶ A seventeenth-century traveller noted that one species of 'lentisk' (i.e., terebinth) in Greece was a source of soap-ashes.³¹⁷ GALLS also occur on the terebinth. This and its BARK were traditionally exploited for tanning and dyeing purposes,³¹⁸ as were its leaves.³¹⁹ The wild terebinth was therefore one of the most useful of the spontaneously occurring trees of the E.Mediterranean, and one hesitates to simply equate *terebinthine* with natural turpentine.

314. See *Polunin* 202 for the distinction between the extracts of the terebinth in general and the mastich-tree in particular. See Gavrieldides, *art.cit.* n.13, 152, for the exploitation of the wild terebinth until recent times.

315. See Semple, *The Geography of the Mediterranean Region. Its relation to Ancient History*, 282; also *Geoponica* 7.12.28.

316. *Sophocles*, s.v. See *Geoponica* 9.18.1 and 16.8.2 for the oil (*elaion*) extracted from the berries (τοῦ καρπούτης τερεβίνθου). The collection and exportation of the berry was noted by Belon in S Macedonia in 1546: *Belon*(1) 113. See *Sfikas*(2), no.103 for *p.palastina*.

317. *Rackham*(2) 331.

318. *Belon*(2) 126; *Polunin* 202.

319. *Belon*(1) 113.

τραγάκανθα

A gum exuded by and tapped from shrubs of the *Astragalus* family,³²⁰ used in medical preparations. In the Middle Ages it was produced in S.E. Anatolia, whence it was exported.³²¹ It was also exported from the Peloponnese,³²² and from N. Syria.³²³

Wormwood/ἄψινθιον, ἄψιθεα³²⁴

A group of shrubs of the *Artemisia* family: see *Sfikas*(1), no.54. Called in Modern Greek αψιθιά and variants. *Diocletian* 36.65 regulates the price of ἄψινθιον (wormwood, or extract of wormwood?). *Aezani* 34.19 regulates the price of *Apsinthei* (sic) *in herva pontici*, which shows it being traded as a primary product.³²⁵ *Aezani* may well refer here to *artemisia pontica*,³²⁶ known as 'Roman wormwood'.³²⁷ An oil was expressed from its leaves and shoots. The wood, leaves, and oil, were used variously to repel or kill insects.³²⁸ The plant and its extracts were used in medical preparations and drinks, including wines,³²⁹ called ἄψινθίτης or ἄψινθάτον, which were attributed all kinds of 'medicinal' properties.

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320. Presumably mainly from *a.tragacantha* (*Van Wijk* 1, 144). It has been called in English 'adragant', 'astragal', 'tragacanth', 'goat's thorn' and variants thereof.

321. *T.I.B. 5. Kilikien und Isaurien* 111. It continued to be exported from Anatolia (*Van Wijk* 1, 142).

322. *Zakynthos, Le despotat grec de Morée* II 237. It continued to be exported from the Peloponnese (*Van Wijk* 1, 142).

323. *Goitein* 213.

324. *Ducange*, ss. vv.

325. See *Aezani* 205 (Commentary).

326. See *Van Wijk* 1, 127 for this plant.

327. *Geoponica* 2.27.6, 2.36.4, 13.1.9, 13.15.1. See *Aezani* 205 (Commentary) and *Lauffer* 286 for Antiquity.

328. For Antiquity see *Aezani* and *Lauffer*, loc. cit. See *Geoponica* 2.47.7, 7.24.1 and 8.21, for wormwood in wines.

329. See *Geoponica* 2.47.7 and 8.21 for the former, where it is attributed all kinds of 'medicinal' properties. See *Ducange*, s.v., for the latter.

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- Belon*(1) P.Belon, *Les observations de plusieurs singularitez et choses memorables, trouuées en Grèce, Asie, Indée, Egypte, et autres pays estrangers* (Anvers 1555)
- Belon*(2) *op.cit.* (Paris 1588)
- Diocletian* *Diokletians Preisedikt*, ed. S.Lauffer (Berlin 1971), TEXT (89-211 and 299-305)
- Ducange* C.Ducange, *Glossarium ad scriptores mediae et infimae graecitatis* (Lyons 1688)
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